

UNIVERSITY OF QUEENSLAND

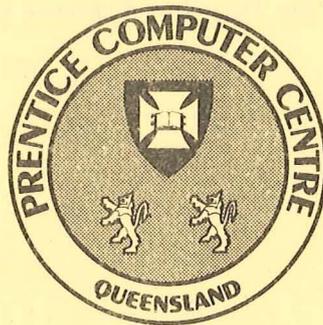


PRENTICE
COMPUTER
CENTRE

Technical Manual No. 1

January 1986

PRENTICE COMPUTER CENTRE



GENERAL INFORMATION

Technical Manual Number 1

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PREFACE

The purpose of this brochure is to provide a summary of the services and facilities offered by the Prentice Computer Centre and the administrative arrangements necessary to make use of the Centre.

This manual is intended for users new to computing or unfamiliar with the systems and services available from the Prentice Computer Centre.

New clients may need to consult other manuals which are available for reference or purchase in the Hawken Service Area, Ground Floor, Hawken Building.

1. GENERAL INFORMATION

1.1 *Introduction*

The Prentice Computer Centre is a central support department for the University of Queensland and Griffith University. It provides interactive and batch computing services at prescribed rates. The Centre assists teaching, research and administrative work throughout the Universities by the provision of specialized programming and consulting services, the survey and development of general use programs, the development of specific programs on behalf of users (at prescribed charges), the provision within budget constraints of state-of-the-art hardware facilities, and the development of communications facilities. It also offers a data entry service, as well as software and engineering support services for departmentally-owned computing equipment. The Centre provides services to external clients, other educational institutions, and State and Commonwealth Government departments who have special requirements which may be best met by the equipment and facilities available at the Prentice Computer Centre. There are currently more than 160 user departments and organizations with approximately 4500 individual user accounts on three computer systems. The computers are in operation on an attended basis for much of the time for five days of the week, and on an unattended basis in the early mornings and at weekends.

The Prentice Computer Centre should not be confused with the Department of Computer Science which is the academic department responsible for teaching and research in computing at the University of Queensland. Enquiries regarding formal course offerings should be directed to that department.

1.2 *Services Summary*

COMPUTER SERVICES — Interactive and batch computing services based on IBM and Digital Equipment Corporation (DEC) mainframes.

NETWORK FACILITIES — Extensive range of facilities, including access to the main computers from remote terminals or personal computers, transfer of information files between computers and electronic mail between host computer systems on-campus as well as nationally and internationally.

SPECIALIZED HARD-COPY PERIPHERALS — Phototypesetter (for book quality printing), letter quality printer, electro-erosion printer, laser printer and plotters, together with associated software packages.

CONTRACT PROGRAMMING — Availability of a pool of analysts and programmers to assist users with the development of computer applications.

APPLICATIONS PACKAGES — Support for a wide range of applications packages in most areas of interest to the academic community.

TRAINING AND CONSULTING — Class and audio-visual courses, general and specialist consulting.

MANUALS AND NEWSLETTER — Manuals for languages, packages, etc. for reference and sale, and a regular newsletter to notify changes and developments.

ADVISORY SERVICES — Advice on planning and procurement of computing equipment.

PERSONAL AND MINI-COMPUTER SUPPORT — Hardware and software development, maintenance and support.

DATA PREPARATION — Data entry and verification.

PROGRAM LIBRARY — A large range of programs covering most disciplines are available in the program library.

1.3 Policy, Management and Administration

The Director is the chief executive and technical officer of the Prentice Computer Centre. He is responsible to the Prentice Computer Centre Management Committee for the effective functioning of the Centre within prescribed policy, and acts under the general direction of the Deputy Vice-Chancellor (Fabric and Finance), University of Queensland, subject to control by the Senate of the University.

The Management Committee consists of the Deputy Vice-Chancellor (Fabric and Finance), University of Queensland; the Vice-Chancellor, Griffith University (or nominee); the Chairman of the Research Committee, University of Queensland (or nominee); the Head of the Department of Computer Science, University of Queensland; the Chairman of the Computing Policy Committee, University of Queensland; the Business Manager, Griffith University, and the Director of the Prentice Computer Centre.

The University of Queensland has a Computing Policy Committee and Griffith University has a Computing Committee. These Committees represent the teaching and research interests of each University, together with the needs of Administration. The Director of the Prentice Computer Centre is a member of both Committees. The Committees are concerned with the planning and co-ordination of computing resources, both central and departmental, throughout the Universities.

1.4 Location

The main offices and central computing equipment of the Prentice Computer Centre are located at the eastern end of the Hawken Building (Building No. 42) on Staff House Road. The Centre's teaching area and the Engineering and Communications division are in building No. 15 near the Physics Annexe. At Griffith University, Nathan, the computer section may be found in Room -1.15 in the Science 2 Building, and courses are held in the S.I.A. terminal laboratory, room 1.49 in the S.I.A. building.

See Appendices A and B.

1.5 Opening Times

See Appendix D for the hours when operators are on duty in the Hawken Building.

These times are referred to as *attended* hours or sessions. The systems are intended to be available during these attended hours and also for much of the remaining time on an unattended basis. During the unattended times, no services requiring the attention of an operator may be performed. For example:

- (a) No output can be printed.
- (b) No disks or tapes can be mounted.
- (c) If a non-recoverable machine failure (or 'crash') occurs, the system will not normally be restarted until the next operator-attended session.

The times for general enquiries and receipt and dispatch of work are also shown in Appendix D.

In the Hawken Building, self-service pigeon holes are provided for the distribution of output. These may be locked if desired.

1.6 Accounting

It is the Universities' policy that computing services provided by the Prentice Computer Centre for the University of Queensland and Griffith University be charged on a real money basis. The Centre must, from the charges levied, recover the full cost of operation (including staff salaries) each year.

All accounting enquiries are handled at the Hawken Service Area. See Appendix D for times.

1.7 Registration as a User

An appropriate form, available from the Centre, must be completed. Since the use of computing facilities costs money, it must be signed by a financial delegate in terms of the Conditions of Use and Liability Statement (see Appendix J).

Intending external (that is, other than University) users must first apply to the Director for approval to establish an account. The attention of prospective external users is drawn to the minimum monthly charge which applies.

2. CLIENT SERVICES

The Prentice Computer Centre offers a wide range of Client Services. Contract programming and data preparation are handled by the Applications Development Group, while the Distributed Computing Group is concerned with supporting departments in the purchase and operation of their computer equipment. This group is also involved in the sales and support of personal computers to bona fide University staff and students.

2.1 *HELP Desk*

The Centre endeavours to assist users in the effective use of computers and offers a HELP Desk service covering all aspects of computer usage. Users should bear in mind that Computer Centre staff are involved in other support activities and a balance must be struck between scheduled work and consultation. For this reason, the following procedures have been established:

- (a) Undergraduate students must take all their computing problems to their academic supervisor.
- (b) If a user requires assistance, he should contact the HELP Desk. This can be done by sending electronic mail to CCHELP on any of the central computer systems or by phoning the HELP Desk (see Appendix C).
- (c) If a user requires a personal visit to a specialist consultant concerning a particular problem, an appointment must be made with the consultant. A problem specification form must be completed prior to the appointment, and all relevant program and data listings produced at the consultation.

No charge is levied for short consultations, but standard charges may be applied to lengthy consultations carried out on a user's behalf (see Appendix E). This charge is levied at the discretion of the Prentice Computer Centre.

It is beneficial to the Centre and all users if suspected computer and system program faults are brought to its attention as quickly as possible, and a charge would not, of course, be levied in this case.

2.2 *User Information*

The Prentice Computer Centre provides a variety of information for clients regarding different aspects of the Centre, its resources and its development.

Computer System Status Service

The Computer System Status Service is a recorded telephone answering service giving users details of times for attended and unattended service and the state of the system. See Appendix C for the telephone number.

On-line Information

Important announcements may be displayed on clients' terminals automatically when a session is commenced or when certain utilities are invoked. Other information and help is available from the computers on demand.

Newsletter

The Prentice Computer Centre Newsletter provides timely information about changes to machines, services and programs, and other information of general

interest to the Centre's clients. It is mailed to the head of each University department or section, nominated liaison staff and, on request, other active users. Please contact the Centre (see Appendix C) if you do not have ready access to a copy and would like to be included on the mailing list. Recent newsletters are kept on-line on all systems, and printed copies are also available from the Hawken and Griffith Service Areas.

Manuals

The Centre stocks a range of manuals detailing the various facilities offered. These manuals, covering many languages and utility packages available on the various machines, may be purchased at the Hawken Service Area.

Manuals are also available from the Bookshop at Griffith University, or from the Batch Station there by requisition only.

Program Library

The aim of the program library is to make available to users as many software packages and routines as possible. Material included in the library comes from a wide variety of sources. In addition to material from manufacturers, user groups and other Universities, users are invited to contribute programs of general use. Requests for additional programs to be included should be made to the Manager, Central Computing Facilities providing full details of the programs required, and where applicable, the name and address of the institution offering the programs, the charge (if any), and any known conditions or restrictions.

The Program Librarian will be pleased to assist clients with any difficulties. Phone numbers are listed in Appendix C.

2.3 Courses And Seminars

The Prentice Computer Centre regularly conducts short courses on the use of its computer systems and other services. While these courses are intended primarily for members of staff and postgraduate students (who are admitted free of charge), non-University users may enrol upon payment of an appropriate fee.

These courses currently include:

- (a) introductory courses (for users unfamiliar with computing in general or with the particular machines operating at the Centre)
- (b) courses on various computing 'packages' available, e.g.
 - statistical packages
 - database management systems
 - text-processing packages
 - graphics packages
- (c) elementary programming courses in both the FORTRAN and BASIC languages
- (d) courses in the use of personal computers.

Occasional seminars are held to discuss recent developments in items of hardware or software. In addition, where particular groups indicate a desire for a special course, seminar or demonstration, such meetings can normally be arranged.

Courses at St Lucia are normally held in the Computer Centre's teaching area near the Physics Annexe. Courses at Griffith University are held in Room 1.49, East Wing, S.I.A. Building (see Appendices A and B). Details of forthcoming courses are notified in the Newsletter. Course enquiries should be directed to the Computing Education Officer, and enrolments made by phoning the Computer Centre (see Appendix C).

2.4 Contract Programming

2.4.1 Preliminary Assistance

A limited amount of free assistance is available to help people using or wishing to use computing for teaching, research, administration and support. This includes —

- advice on choice of appropriate application systems
- preliminary system design work
- estimates of programming and machine costs for submissions to research funding bodies.

Contact the Manager, Applications Development in the first instance for help in this area.

2.4.2 Availability of Specialized Programs

Subject to the availability of programming staff, the Prentice Computer Centre will undertake paid programming work for clients on a contractual basis. Charge rates vary depending on the size and type of project and whether the client is classed as Group 1, Group 2 or Group 3 (see Section 5.1).

A variety of special systems has been developed in connection with projects undertaken at the Centre, and a user with a special requirement may find it worthwhile contacting the Centre to discuss whether suitable software is available in the Program Library. These developments include special file access techniques, data entry packages, word processing packages, data storage and retrieval systems, form generation packages for data entry systems, a flexible mail list package, a package and procedures to read and translate a variety of magnetic tape formats, simulators and cross-assemblers for personal and mini-computers, development of program library maintenance procedures and procedures for producing microfiche.

2.4.3 Magnetic Tape Conversion

Provision has been made for the reading of magnetic tapes written at other installations. Clients may elect to do the conversion themselves, or request the Centre to carry out the conversion. Requests are handled in the same way as small programming contracts, i.e. the client is charged for machine and staff time at contract rates (see Appendix E). It is necessary to know the format of the written tape, e.g., density, blocking factor, record length. It is strongly recommended that all possible information regarding the tape and, if possible, a dump of the first few records be supplied. This can be an invaluable aid to the Centre staff converting the tape.

Before transferring files via magnetic tape to another installation, it is advisable to contact that installation to obtain their favoured magnetic tape format. Contact the HELP Desk if tape conversion by Centre staff is required.

2.4.4 Contract Programming Rates

Charges are determined by the size of the job:

- (a) Programming and Systems work for projects involving 25 hours or less of continuous work, or for non-continuous projects ... standard rates (see Appendix E).
- (b) Programming and Systems work for projects of a continuous nature, or greater than 25 hours ... see Appendix E.

For other than University users, rates are by negotiation and will be comparable with current commercial rates.

2.5 Data Preparation

The Centre offers a data preparation service covering entry and verification of data

7. For Project Assessment

at prescribed charges. Special expertise exists for entry of text for typesetting and survey data.

The Data Preparation service is available both on a first-come-first-served basis and by advance bookings (not for verification). The Centre cannot guarantee that work submitted under the first-come-first-served basis will be completed by a specified time.

Reservations for advance bookings will be accepted under the following conditions:

- (a) The minimum time which can be booked is 15 minutes. *Allowed to book 15 mins*
- (b) Bookings should be made at the Hawken Service Area. *) ? How can I book in advance*
- (c) Cancellations should be notified at least 24 hours in advance of an allocated booking, otherwise a charge will be levied for the period booked.
- (d) If the work required is found to exceed the time booked, then the work may be terminated. However, arrangements can be made subsequently for the completion of the work.

Data entry and verification are charged at an hourly rate. See Appendix E.

2.6 Distributed Computing

This section of the Prentice Computer Centre provides four main services —

- (i) Liaison with departments purchasing computer equipment.
- (ii) Distribution and support of systems software for departmental systems.
- (iii) Provision of contract services for hardware maintenance and development projects.
- (iv) Personal Computer Support Centre for the sale and support of personal computers to the two Universities and their staff and students.

2.6.1 Departmental Computer Equipment

The Distributed Computing Section gives advice to departments wanting to purchase computer systems, peripheral equipment and terminals. The Centre negotiates collective purchase contracts with suppliers for a wide range of computing equipment, peripherals, terminals and software. These contracts allow for significant discounts to the University and orders for the purchase of such items should be forwarded to the Centre on a Prentice Computer Centre *Equipment and Materials Order* form (available from the University Store). The following services are available to assist departments in the procurement of computer equipment:

- (i) evaluation of new hardware products
- (ii) advice on all aspects of computer systems
- (iii) ordering of equipment
- (iv) installation of new equipment at standard charges
- (v) acceptance testing at standard charges.

2.6.2 Software Support for Departmental Systems

The programmers in the section provide support for the RSX, RT-11 and TSX family of operating systems for departmental PDP-11s. They also support the major languages, FORTRAN and BASIC, on these machines. Support is also provided for the VMS operating system on the VAX family of systems.

The programmers are responsible for the distribution of new versions of this software, and they attend to any operating system faults that occur.

Staff are available for contract software development of a minor nature for departmental machines. Such work is charged at standard rates (see Appendix E). If software development on a larger scale is required, enquiries should be made to the Manager, Applications Development.

2.6.3 Hardware Maintenance and Development

Hardware Maintenance

This applies particularly to the PDP-11 family, associated third party peripherals and terminals. The major method by which departments have their equipment maintained by the Distributed Computing Section is via an annual maintenance agreement. For a set fee, determined by the particular hardware configuration, the Prentice Computer Centre provides all materials and labour for faults in hardware. Equipment failures dealt with on this basis take priority over casual calls for help. Under these agreements, PDP-11 computer equipment also receives a twice yearly preventive maintenance service.

Faults on equipment not covered by these agreements will be repaired on the basis of a standard hourly rate plus the cost of parts (see Appendix E). The spare parts held by the Centre are funded by the yearly maintenance charges, however, and are not normally available for casual calls.

Contract Hardware Development

A hardware design and development service is available for digital systems particularly micro-processor based systems. For instance, specialist devices can be interfaced to computer equipment. This work is charged at standard rates (see Appendix E).

The Centre has extensive micro-processor development facilities and can program a large variety of fusible link PROMs and EPROMs. Programs can be prepared and assembled on the PDP-10 for convenience, and transmitted to a prototype system or the PROM programmer for testing or programming.

2.6.4 Personal Computer Support Centre

The Distributed Computing Section includes a Personal Computer Support Centre which is located at the western end of the Hawken Building on the basement level. Access is via the laneway at the rear of the building (see Appendix A). The PC Support Centre provides the following services —

PC Sales

Sale of personal computers to the University of Queensland, Griffith University and their bona fide staff and students. A range of personal computers are on display for demonstration purposes. The current systems being offered include PCs from IBM, Apple, Sperry and DEC. The prices and configurations of these systems vary from time to time, and further information should be requested from the Support Centre.

PC Maintenance

Maintenance agreements are available for an annual fee, or faults can be repaired on a time and materials basis. Staff and students are offered return-to-base agreements, while for an additional fee, University departments may elect to enter agreements for on-site maintenance.

PC Software Support

Limited advice and support is provided for personal computer software. Because of the number and diversity of applications, the Centre's ability to help is limited. The personnel in this section will, however, attempt to assist wherever possible.

Versions of KERMIT are available on request (free of charge) to enable users to

access the University network. KERMIT is a software package which enables terminal emulation and file transfer between the central systems and personal computers.

Staff are also available for software development of a minor nature on personal computers. Such work is charged at standard rates (see Appendix E).

Specialized PC Services

For academic purposes, University staff and postgraduate students have access to a range of specialist services in the PC-related area. These include an image scanner, a digitizer, and a laser printer. For short periods of time, certain PCs are also available for hire. Charges for use of these services are available on request from the Distributed Computing HELP Desk (see Appendix C).

LaserWriter Service

The LaserWriter is a near-typeset-quality text and graphics printer for use with an Apple Macintosh personal computer. It prints with a resolution of 300 x 300 dots per square inch and may be used by staff and postgraduate students. Requests for bookings and further information should be directed to the Distributed Computing HELP Desk (see Appendix C).

2.7 Engineering and Communications

The Engineering and Communications Section provides a range of services on both a consulting and contract work basis.

2.7.1 Engineering

It is the function of the Engineering group to take responsibility for the standards of all the computer equipment and related hardware, and also for the design of specialized computer-based digital systems.

2.7.2 Communications

Generally, the section is responsible for development of all data communications facilities. This involves a very broad range of services including —

- on-campus physical services such as twisted pair, coaxial cable and optical fibre
- installation and maintenance of modems, multiplexers and line drivers for asynchronous and synchronous transmission
- Local Area Networks such as ETHERNET
- Packet and Circuit Switched Networks and gateways
- off-campus services provided by Telecom and the Overseas Telecommunications Commission.

Refer to Appendix K for charges for the above services.

2.7.3 PCB Design Service

The Centre provides a contract service for Electrical Schematic generation and Printed Circuit Board design. The Electrical Schematic Service includes data entry, consistency checking, plotted output of schematics, and printed parts and wire lists. The PCB design system provides automatic placement of components on the board and automatic track routing. Several algorithms are available for optimising the layout of the board.

The Centre is able to provide quick turn around, particularly for prototyping, through its arrangements with photoplotting services and PCB manufacturers.

PCB design services are offered on a contract basis at competitive rates. See Appendix E.

3. SPECIALIZED FACILITIES

Central computing services are provided on mainframe host computers, namely an IBM 3083E, DEC VAX 11/780 and dual processor DEC KL10. All these machines are accessible via the network and together provide a range of user operating environments.

The software available on each machine provides for a range of both academic and administrative use and includes extensive statistical analysis suites, mathematical libraries, text processing, graphics and communications functions. The host computers and the services available on each are discussed individually in later chapters of the manual.

In addition to these host computers, the Centre has a number of items of associated equipment (e.g., plotters) which provide the user with a range of specialised computer-based services. Generally these devices are networked to the host computers, i.e. connected so that each device can be used from any host machine. Indeed, with appropriate software, many of these devices can be accessed from personal computers via the communications network.

3.1 *Telephone Direct Connect Modems*

Personal computers and terminals may be connected temporarily to the Prentice Computer Centre network. Direct connect modems as well as terminals (with built-in modems), are available for short-term connection or 'coupling' to the computer systems via a normal telephone line.

In order to connect to the systems, a user with a coupled personal computer or terminal has a choice of telephone lines catering for different line speeds:

- (i) 300 bps line
- (ii) 1200 or 2400 bps line
- (iii) 1200/75 bps line

See Appendix F for the phone number for booking these devices, the dial-up modem telephone numbers and the hire charges.

3.2 *Letter Quality Printer*

A Facit printer, capable of letter quality output and accessible from all three systems, is available for the production of theses, reports, manuals and other documents. It is situated in the Hawken Service Area and requests for bookings should be directed to that area.

For the basic charge for using the printer, see Appendix F. In addition, clients need to purchase the ribbons and print wheels they require from the Centre. These cannot be hired or 'part' purchased. Refer to Appendix F for a guide to the prices of these consumables.

The Facit printer can be hired for a maximum of two hours at a time. If there is no further immediate booking, the user may be granted an extension of the hire period.

3.3 *Typesetter*

The University has a *Compugraphic MCS8400* phototypesetter which is situated at the Centre and is accessible from the VAX and KL10 computer systems. Approximately 80 fonts are available in various typesizes from 5 to 72 point (about 2 to 25mm). Maximum line length is 69 picas (about 300mm). See Appendix F for typesetting charges.

Via KL10

Work may be directed to either of two queues. Work in the normal queue will be processed when the total quantity reaches the equivalent of 30 A4 pages. Urgent work directed to the high priority queue will be processed immediately and should be available after approximately 20–30 minutes depending on the volume.

Via VAX 11/780

The times for clearing the normal queue will be the same as for the KL10. There is no URGENT queue on the VAX. Urgent jobs may still be typeset immediately by copying the file to the KL and submitting it as an URGENT job.

3.4 *Electro-erosion Printer*

An IBM 4250 printer will be attached to the IBM 3083E system early in 1986. It is a text and graphics output device which creates printed dots at a density of 600 × 600 dots per square inch, producing a high quality image that can be used as a camera-ready master or inserted into a copier or direct-plate maker. It may be necessary to experiment with different copier settings to obtain optimum results.

The electro-erosion technique prints the image by applying an electric current to 32 electrodes in contact with special aluminized paper. The current vapourises the aluminium coating thus exposing an underlying contrasting layer. There is a large range of typeface families available in various sizes ranging from 6 points to 72 points. All points are addressable which allows the placement of both text and graphics at any point on the page. Charges are given in Appendix F.

3.5 *Laser Printer*

Early in 1986, a laser printer is to be connected to the IBM 3083E system. The printer is an IBM 6670/002 which produces intermediate quality output suitable for documentation, lecture notes, etc.

The device is like a photocopier with a computer interface. Print speed is approximately 10 pages per minute for the first copy and 36 pages per minute for subsequent copies. A fair range of typewriter style fonts is available as well as a limited number of proportional fonts. Output for the line-printer or from the Document Composition Facility (DCF) can be directed to the laser printer. In the case of DCF, the output must, however, be pre-processed before printing. For charges, see Appendix F.

3.6 *Plotters*

Introduction

There are several plotters available for public use —

At Prentice Computer Centre	(i) HP7585
	(ii) HP7475
	(iii) Calcomp 936
At Griffith Computing Services	(iv) HP7475

The plotters can be used for a large range of applications from graphs and charts to printed circuit boards to civil engineering design.

Charges for processing time can be found in Appendices H and I, while set-up charges and stationery costs appear in Appendix F.

Output from the Calcomp plotter is on continuous stationery which makes it very suitable for certain jobs, such as very long graphs. The IBM generates output for the HP plotters. The VAX and KL operate all the plotters, though many programs give output to the Calcomp only.

The quality of the output from the HP7475 is adequate for most purposes, and clients are encouraged to use this piece of equipment in preference to the HP7585, unless they have a job with large output.

Plots can also be previewed on any Tektronics 4010 or GIGI graphics terminal.

HP7585

The HP7585 is a high-precision, single-sheet plotter with a step-size of 0.025mm and eight pens which are program selectable. Users have a choice of roller-ball, fibre-tip, or liquid-ink drafting pens in various colours and line-widths. The standard sizes of the drafting pens, which contain black ink, are 0.25, 0.35, 0.5 and 0.7mm. Roller balls are available in black, blue, red and green. Fibre pens come in the same colours, with their sizes being 0.3mm and 0.7mm.

Paper sizes from A4 to A0 can be accommodated, as well as normal paper and drafting film (tracing paper).

HP7475

The HP7475 is a six-pen, single-sheet plotter, utilizing A3 and A4 stationery. Fibre tip pens are available on this plotter with a choice of widths — 0.3mm and 0.7mm. Black, blue, red and green are the ink choices offered, and normal paper or overhead transparencies can be used. On the plotter at Griffith University, A3 size normal paper is the only medium available.

Calcomp 936

The Calcomp 936 is a 914mm (36") incremental drum plotter with a step size of 0.05mm and three pens which are program selectable. Biro's are available in black, blue, red and green. Three sizes of black ink drafting pens are available — 0.35, 0.5 and 0.7mm. If no specification is given, the plotter selects a blue biro by default.

3.7 Computervision CAD/CAM System

3.7.1 The System

The Centre has available for general use a monochrome workstation connected to a Computervision CDS4000 CAD/CAM System. There are additional workstations in departments such as Mining and Metallurgy, Mechanical Engineering and Surveying.

CAD/CAM (Computer Aided Design/Computer Aided Manufacture) provides the user with an integrated set of computer aids from initial drawing, through detailed design, to final manufacture. A powerful interactive graphics facility allows the user to create a model of an object, in 2 or 3 dimensions, as necessary. Drawings of this model can be annotated with text, dimensions and additional geometry to produce final presentations of high quality. Standard components and shapes can be created as library parts to speed production of repetitive drawings.

Initial drafting of the object creates a model database, available to any subsequent operations. For example, later revisions of a drawing become straightforward updates of the original database. A variety of analytical procedures can be applied to the model database, depending on the application, e.g., printed circuit board

design, tool path generation, finite element modelling, plant design and mapping. Finally, the system can produce various forms of output, e.g., plot files for PCB artwork, control tapes for numerical control tools, lists of materials, etc.

CAD/CAM is capable of achieving dramatic increases in productivity in areas where it is possible to automate manual procedures. It exploits a common database to reduce unnecessary operations, and improve communications between steps in a production sequence.

Drawings up to A0 size may be output on the Centre's HP7585 drafting plotter. For applications requiring higher quality output, arrangements can be made with photoplotting and pen plotting services outside the University. In addition, a dot matrix printer provides low quality copy of the workstation screen.

Charges for use of the public workstation are \$20/hour. Rates for block bookings for specific projects are negotiable. Plotting on the VAX will be charged at appropriate VAX rates.

4. THE COMMUNICATIONS NETWORK

4.1 Introduction

The University of Queensland and Griffith University Data Communications Network, UQNET, has extensive capabilities. The services it offers include terminal access to any of a number of host computers, the ability to transfer files through the network, and communication between computer systems and machines on and off the campus. Computer systems throughout Australia and overseas can be accessed, and world-wide electronic mail is available.

The staff operating the Campus Data Network offer a consultation, installation and design service for a variety of cables, multiplexers, modems, and so on.

The network configuration chart shown in Appendix L is a conceptual diagram, and is not the way the network is physically connected. It represents more what the user 'sees'. The diagram demonstrates the high level of interaction between the various computing systems on campus. A collection of hosts and terminals with common and compatible facilities is usually called a 'network', and the interconnections between different networks are 'gateways'.

The links are necessary because, for instance, special peripherals such as letter quality printers and typesetters are expensive, and the Prentice Computer Centre may have purchased just one of each. In addition, software packages (SQL, SPSS, SYSTEM 1022, etc.) often reside on only one host due to compatibility, machine configuration requirements or licensing costs.

There are over one thousand terminals scattered around the two campuses, as well as several hundred micro-computers and personal computers, about one hundred mini-computers and, currently, three large hosts. The computers and terminals are interconnected in a number of ways, both hardware and software being required to allow data or other messages to be sent from one system to another.

Every computer in a network is called a 'node', because it is at the end of a communications line. The computers on which a user may process work are called 'hosts', and to use any particular host, the client must first obtain authority and establish an account on that host machine. The Centre's mainframe computers are hosts, as are all the departmental mini-computers. Non-host computers perform functions such as message-switching.

4.2 The Circuit Switched Network

The Prentice Computer Centre's Circuit Switching System is based on MICOM Model 600/2's. The primary purpose of the Circuit Switch is to give asynchronous terminals access to the large central hosts in the Computer Centre. Any device, such as another computer or a personal computer, can be connected via the Circuit Switch, as long as normal 'terminal' protocols are observed. This system has in excess of 1100 lines installed at present.

The system is similar to the switched telephone network in that, after 'dialling' the required number, an actual circuit or connection is set up and dedicated for the duration of the call. As well as linking terminals to a host computer via an actual circuit or connection, the MICOM Circuit Switch performs other functions such as

queuing and access management. Some terminals can be restricted from accessing a particular host.

See Appendix L for a list of host computers available.

4.3 *The Packet Switched Networks*

The packet switched networks provide a method of information exchange between computers in the form of 'packets' or 'messages'. Each packet contains user data and is enveloped with special information giving source and destination addresses and ensuring error-free transmission. The concept of a physical circuit, such as in the circuit switched network, does not apply here. Rather, there is an end-to-end connection established called a virtual circuit, which allows the two host computers great flexibility and a rich variety of functions to exchange information.

Some of the typical facilities offered between host computers are:

Virtual Terminal — Allows a terminal actually connected to one host to operate as a virtual terminal to another host. Indeed, this is a similar function to the circuit switch, but there is more functionality. Also, this facility allows operation via gateways off-campus.

File Transfer — Programs and data files can easily be transferred error-free between most computers. The effective speed of transfer can range up to 50,000 bytes/sec, so quite large amounts of information can be transferred quickly and accurately.

Process-Process Communication — It is usually possible for two programs running on different hosts to communicate by passing messages.

Electronic Mail — This is a very useful feature of computer networks, and indeed of any computer system. It provides a means for sending and receiving messages, just like any normal mailing system. However, electronic mail has many advantages, e.g., it's much faster and it's cheaper (for reasonably short messages). Also, unlike a telephone call, the receiver does not need to be present when the message is sent.

As there are a number of electronic mail systems available, they will not be discussed in detail here. Some of the more commonly used message systems are MAIL on the KL10, NOTE on the IBM, and for messages further afield, MINERVA is operated by the Overseas Telecommunications Commission (OTC) and TELEMemo is offered by Telecom Australia. There is a lot of on-line documentation available for the mail systems currently in use at the University. For further information, contact the HELP Desk.

Examples of Packet Switched Networks

The ANF-10 Packet Switched Network was developed for the DECsystem-10 range of computers, and mainly handles remote terminals and printers and remote job entry operations. The network extends to Griffith University. The ANF-10 network has gateways to the CSIRO network (CSIRONET) and TELECOM's Public Packet Switched Network (AUSTPAC).

The DECnet network was developed initially for the DEC PDP-11 range of computers and now includes the VAX series. This network is used to connect the computers running the RSX or VMS operating systems.

See Appendix L for the Network Configuration.

4.4 *Gateways*

Various gateways allow different networks to interconnect. Often users are not

aware they have used a gateway, as much of its function is to iron out network differences. It is wise to keep in mind, though, that the gateway's translation of one network language or protocol to another is often incomplete, just as in spoken languages.

The off-campus gateways allow access to many other Australian and overseas networks. Terminal access, file transfer and electronic mail is possible to the USA, UK and Europe. These facilities are improving rapidly, and new features are constantly being added. Avid 'networkers' are advised to watch for new facilities in the Prentice Computer Centre newsletter and updated versions of the publication *UQNET In Brief* (see Appendix L).

4.5 CSIRONET

The CSIRONET gateway allows access to the CSIRO's extensive computing facility as well as to other non-CSIRO hosts, such as ourselves. For details, contact:

CSIRO Cunningham Laboratory,
306 Carmody Road,
St Lucia, 4067. (07)377 0300 TLX AA42159

4.6 AUSTPAC

AUSTPAC is a packet switched network operated by Telecom Australia, and as such, has connections to many sites Australia-wide. AUSTPAC has a gateway to OTC's MIDAS network which gives access to similar networks in about 30 countries, including the USA and Canada, the UK and much of Europe.

Facilities such as virtual terminals, file transfer and electronic mail are available, but not to all possible sites. Arrangements can often be made, however, so please contact the Centre if you have special requirements.

4.7 Personal Computers

There are many so called 'LANs' or Local Area Networks available for personal computers. These are often oriented to a small geographical area such as a laboratory or building. Locally, such LANs can provide file server and print server facilities, etc. These networks are often limited and proprietary, and so some gateway facility is required to interface to other networks.

4.8 KERMIT

KERMIT is a terminal emulation and error-free file transfer package for computers. It allows communication to be established between any two computer systems running KERMIT, such as a mainframe and a personal computer.

There are versions of KERMIT on all the Centre's mainframes, and versions are available for the PDP-11 family and many of the personal computers on the market. Currently, KERMIT is available through the Centre for IBM, Apple II, Sirius, NEC, DEC Rainbow, Osborne I and Exec, Kaypro II and IV, HP150, MICROBEE, and Apple Macintosh personal computers, and PDP-11s running RT-11 and RSX-11M.

Information on the use of KERMIT is available on the KL10 as the file DOC: KERMIT.MAN. KERMIT is public domain software, but you are reminded that the protocols are copyrighted to Columbia University Centre for Computing Activities, and it has directed that KERMIT should be used for non-commercial and peaceful activities only.

(WFO KERMIT on IBM
HELP KERMIT on VAX

All enquiries concerning KERMIT should be directed to the electronic mail address MICROS.

4.9 Data Communications Facilities

The communications facilities are summarised along with handy telephone numbers and other communications addresses in *UQNET In Brief*. A copy is attached as Appendix L, but the most recent issue is always available from the Hawken Service Area.

The schedule of charges for network connections and maintenance is given in Appendix K.

5. MACHINE SYSTEMS

The available interactive systems which are discussed in separate chapters are:

- (i) IBM 3083E System
- (ii) Digital Equipment VAX 11/780
- (iii) Digital Equipment PDP-1099 dual processor system (KL10).

Certain areas of operation are common to all systems in the Prentice Computer Centre, while others may apply to only one or two machines. A charge factor is applied to all work processed on the central systems, and this is discussed in detail below. There are some common areas and some areas of variation in relation to private storage. On the other hand, backup of users' files covers largely the same ground on all three machines.

5.1 Charge Factors

A charge factor is applied from one of four charge groups depending on the fund source and the nature of the work. The groups are:

Group 1 – Base Rate (applies only to work for University of Queensland, Griffith University and affiliated or public interest non-profit organisations approved to be in this category)

- Teaching and Administration.
- Research work from University recurrent grants or grants provided by Government funding agencies (e.g. ARGS, NHMRC).
- Departmental research projects funded by external sources which conform to the Conditions of Acceptance of Research Grants as specified in Sections 7.271 and 7.272 of the revised University of Queensland Handbook of Administrative Information.
- Processing work of a minor nature for non-profit organisations working in the public interest and approved by the Vice-Chancellor, University of Queensland.

Group 2 – Intermediate Rate

- Work for other educational institutions.
- For-profit research projects contracted to the University of Queensland through UniQuest.
- For-profit research projects contracted to Griffith University and advised by the Business Manager, Griffith University.

Group 3 – External Rate (subject in each case to approval by the Director, Prentice Computer Centre)

- Work for external clients.
- For-profit research projects not arranged through UniQuest or the Business Manager, Griffith University are regarded as external work, and the account at the Prentice Computer Centre should be in the name of the client.

Group 4 – SLOTS Rate (Student Low Overhead Time-Sharing Service)

- Undergraduate student course work (KL10 only).

Modifying Factors

These Modifying Factors are applied to the above charge rates:

	<i>IBM</i>	<i>VAX</i>	<i>KL</i>
Base	1	1	1
SLOTS	N/A	N/A	0.33
Intermediate	2	5	2
External	3.7	9.9	3.7

- Note:
- The VAX base rate is approximately equal to the KL SLOTS rate.
 - The modifying factors are applied to the charges for each machine listed in Appendices G, H and I. The SLOTS rate is one-third the KL base rate for processor time, memory and file I/O. Charges for operator services and consumables (Appendix F) are not modified by the above factors.

5.2 Private Secondary Storage

VAX and KL

As well as the allocation on the public file storage area, clients with special storage problems may hire private disk packs and magnetic tapes for their own use. Enquiries should be directed to the Operations Manager.

5.2.1 Private Disk Packs

VAX and KL

Depending on availability, packs may be hired on a monthly basis or, alternatively, on payment of a capital contribution, a private disk pack will be made available to a user for a period of three years. Disk packs remain the property of the Prentice Computer Centre and may not be taken from the Centre. The Centre will replace faulty packs. No pack from another installation will be processed at the Centre. As well as the hire charges for packs, the usual charges for device usage and file input/output apply, but there is no charge for file storage.

Use of disk drives for the mounting of private packs may be booked in advance at the computer room (see Appendix C). A one hour limit applies to bookings from 8am-6pm, while after 6pm disk drives may be booked for a period of two hours. These limits are not enforced if the drive is not required by another user. Disks may be booked for use during any unattended sessions including Sundays by ringing the computer room. These latter requests should be followed by written confirmation indicating the user and pack identification. A request for immediate mounting of a pack will be honoured if possible, depending on the availability of a drive. Notice of cancellation of a booking is appreciated. In the case of the system not being available, the user will be charged only for the time during which the system was available. It will not be possible to extend the period of a booking which has been interrupted by a system crash, if other users have booked the drive for use after the period in question.

5.2.2 Magnetic Tapes

All Machines

The use of tape drives may be booked in advance under the same conditions that apply to the booking of disk drives.

However, as operator intervention is necessary for their use, magnetic tapes cannot be used in any unattended session. Clients are warned that although bookings can be made, scheduled system functions may inhibit availability of these drives. Magnetic tapes may be bought privately or hired through the Centre. If processing

of tapes which have been stored away from the Centre is required, it should be noted that a 24-hour acclimatization period within the Centre's air-conditioned environment is required before the tapes are used.

Arrangements must be made with the Centre for registration of tapes before use. An external label will be affixed to the tape and this label number is used for all future identification.

Limitation of Magnetic Tape Service

It must be appreciated that with such a large number of individual users, the widespread use of magnetic tape (e.g., as a means of extending storage allocation) is operationally impossible. Clients are requested to restrict the use of magnetic tapes to essential needs that cannot be met by the disk system, e.g., communication with other machine systems outside the network.

5.3 Backup

All Machines

The Prentice Computer Centre is formally excluded from liability for the loss of information from data or program files. In practice, the Centre provides backup for the public areas and on request will arrange backup for private file storage. The Centre's backup system provides a high measure of reliability and is generally satisfactory for the normal processing which takes place. However, it is not absolutely foolproof and, if very critical data is involved, users should make further arrangements for security of their files.

5.3.1 On-line File Storage

Weekly: a total system backup is completed. These files are kept for three weeks.

Daily: a copy to tape of all files accessed in the previous day is taken. These tapes are kept for one week.

Please note that users' T-disk (temporary disk), spool file areas, and SQL space on the IBM 3083E are NOT backed up.

5.3.2 Private File Storage

It should be noted that magnetic tapes and private disk structures are *not* automatically backed up and users should make independent arrangements if necessary. Of course, backup of such data is always advisable, and the Centre will, for a fee, back up users' private disk structures if requested to do so. To make such arrangements, contact the Operations Manager.

5.3.3 File Retrieval

A minimum charge per file is levied for retrieval from these backup systems. Requests may be made by completing a *File Retrieval Request* form and submitting it to the Operations Section. Files should be restored to your area overnight.

6. IBM 3083E SYSTEM

6.1 Introduction

The IBM 3083 is a general-purpose timesharing system executing under the control of IBM's VM operating system. It is our most powerful computer system offering a diverse range of software. The IBM is particularly suitable for large, CPU-intensive jobs.

The VM operating system either allows each user to have an individual virtual machine on which a single-user operating system would typically run, or it permits many users to share a virtual machine which runs a multi-user operating system. In this way, it is possible to provide a range of environments on the one set of hardware. A user's terminal becomes the console of a virtual machine which is controlled via commands to the Control Program. These commands and their responses take the place of the switches and lights found on older real machines and include commands to load the virtual machine with an operating system which is then used to process high-level commands in the normal manner.

6.2 Software

The operating system CMS (Conversational Monitor System) is available on the IBM for single users, and it is intended to make a UNIX (TM) environment available for multi-users.

The *CMS Primer* is recommended reading for new IBM users, and the *Quick Guide for Users* is an excellent reference for commands. IBM documentation is generally extensive, and compact 'reference cards' are available for many programs, including VM/CMS and the language processors. A comprehensive list of titles of manuals is maintained on the system and may be accessed by the command 'INFO MANUALS'. The references given below are for those manuals most likely to be useful. Documentation for IBM products is generally available (or can be ordered) from the Prentice Computer Centre. Extensive HELP is available on the system components, while the products themselves often have HELP internally. In addition, the HELP Desk can provide information regarding which products are available and how to use them.

6.2.1 Language Processors (compilers, interpreters and utilities)

<i>Language</i>	<i>Reference</i>
IBM VS/FORTRAN (for FORTRAN-66 and FORTRAN-77)	SC26-3985 VS FORTRAN Application Programming: Guide GC26-3986 VS FORTRAN Application Programming: Language Reference
IBM OS/VS COBOL	SC28-6469 IBM CMS User's Guide for COBOL SC28-6483 IBM OS/VS COBOL Compiler and Library Programmer's Guide
IBM PASCAL/VS	SH20-6168 Pascal/VS Language Reference Manual SH20-6162 Pascal/VS Programmer's Guide

6.2.2 Installed IBM Programs

<i>Product</i>	<i>Use</i>	<i>Reference</i>
XEDIT	Full-screen editor	SC24-5220 VM/SP System Product Editor (XEDIT) User's Guide SC24-5221 VM/SP System Product Editor (XEDIT) Command and Macro Reference
REXX	Command language	SC24-5238 VM/SP System Product Interpreter User's Guide SC24-5239 VM/SP System Product Interpreter Reference
SQL/DS	Relational database system	SH24-5045 SQL/Data System Terminal User's Guide for VM/SP SH24-5067 SQL/Data System Terminal User's Reference for VM/SP
CSP (Cross System Product)	High-level application generator	GH20-0940 CSP/AD CSP/AE General Information
SCRIPT, DCF (Document Composition Facility)	Text formatting	SH20-9161 Document Composition Facility: User's Guide SH20-9187 DCF Generalised Markup Language: Starter Set Reference

Computer-aided instruction programs:

IIAS	Interactive Instruction Authoring System
IIPS	Interactive Instruction Presentation System
IPF	Interactive Productivity Facility

6.2.3 User Assistance/Information Retrieval Facilities

There are extensive help facilities including NEWUSER, HELP, INFO, SEARCH, and NEWS to assist users in finding information on the system.

The following IBM products are available:

<i>Product</i>	<i>Use</i>	<i>Reference</i>
STAIRS	Storage and Information Retrieval System	SB11-5545 STAIRS/CMS Terminal User's Guide
OZ	Information/System providing access to a large on-line database	SC34-2072 Information/System for VM/370 and VSE User's Guide

6.2.4 Utilities and Support Software

<i>Product</i>	<i>Use</i>	<i>Reference</i>
SAS [®]	Statistical analysis	SAS [®] User's Guide: Basics SAS [®] User's Guide: Statistics
IMSL [®] Subroutines	Maths and Statistics	MNT-3 Statistical Packages The IMSL [®] Library (Available for reference)
SSP	Scientific routines	SSP Programmer's Manual (Available for reference)
PLOTLIB	HP plotting routines	MNT-11 Plotting
IFPS [®]	Financial planning	IFPS [®] User's Manual
PVM	VM/Pass-Through Facility	SC24-5208 VM/SP VM/Pass-Through Facility Guide and Reference

IOS3270	Display Input/Output Facility for writing full-screen utilities	SB11-5820 Display Input/Output Facility Program Description and Operations Manual
SMART	The IBM VM Realtime Monitor	SH20-2337 VM/370 Real Time Monitor Program Description/Opera- tions Manual

6.3 Configuration

The IBM 3083E is rated at approximately 4-6MIPS and early in 1986 will have:

- 16 Mbytes of memory
- 12.5 gigabytes (1 gigabyte = 10^9 bytes) of on-line disk storage
- transfer rate between disk and memory of 3 Mbytes/second
- two dual density (6250/1600 bpi) 9-track magnetic tape drives which can transfer data at 1.25 Mbytes/second
- electro-erosion printer, laser printer, medium speed line printer
- two production Series 1 processors running YALE software to emulate the IBM 3270 protocols for the ASCII terminal types
- connection to circuit switched network (MICOM 600)
- existing RSCS gateway to VAX 11/780 which will be upgraded to a full DNA/SNA gateway early in 1986.

General Restrictions:

1. A video terminal with a line speed of at least 1200 baud is desirable.
2. There is limited support for ASCII graphics terminals on the IBM system.

6.4 Primary Memory Allocation

The amount of memory available to individual user jobs can range from 1 megabyte up to 16 megabytes. However, larger virtual machine sizes are likely to have a higher impact on the overall system performance and are charged accordingly.

6.5 Disk File Allocation

On-line disk storage is allocated in units of 600 Kbytes (1 cylinder) for usual virtual machines and 512 Kbytes for space on shared SQL virtual machines. The storage is provided in increments of one storage unit, the minimum storage being one unit.

6.6 Private Secondary Storage

As well as the normal disk storage allocation, users with special storage problems may hire private magnetic tapes for their own use. See Section 5.2 for details. Please note that for private secondary storage on the IBM 3083E, only magnetic tapes are available, and not disk packs.

6.7 Backup

See Section 5.3.

6.8 Hours of Operation

See Appendix D.

6.9 IBM Charges

Charging for use of the IBM is based on the concept of leasing a virtual machine. This means that the client pays a fixed monthly amount based on the memory size, sizes of mini-disks, and size of SQL database space which he requires. (A

mini-disk forms part of the configuration of a particular virtual machine and, in reality, it is a contiguous part of the real disk.) The fixed charge gives right to unlimited access which is restricted only by the demands placed on the real system by other computer users. Charges for consumables and operator services (stationery, tape mounts, file retrieval, and so on) are, of course, extra.

Information on expenditure on all accounts is sent to departments in the form of monthly statements.

The memory component on which charges are based starts at 1 Mbyte and is available in 4 Kbyte increments. The units of allocation for mini-disks and SQL database space are 600 and 512 Kbytes respectively.

If a client wishes to change the size of any allocations, an *Authority to Establish/Alter an IBM Virtual Machine (AUTH-UQVM)* form must be completed and submitted to the Accounts Section in the Hawken Service Area. The client is then charged on the basis of the larger allocation for the whole month.

Refer to Appendix G for a guide to the monthly charges, and to Appendix F for the costs for operator services and consumables.

6.10 Use of the IBM System

6.10.1 Registration as a User

Use of the IBM 3083E involves, as mentioned above, payment of a fixed monthly amount. When establishing an account, the client must fill in an *Authority to Establish/Alter an IBM Virtual Machine* form. Particular attention must be paid to the *expiry date*, as users are billed up until that date, even in months where no work has been performed on the machine.

6.10.2 Identification and Allocations

Upon registration, a new user establishes:

- (i) Userid — this identifies the user to the system and distinguishes that user's files from other users' files on the disk.
- (ii) Password — the password must be given when logging onto the system as security against unauthorized use of the userid. Although it is initially allocated by the Centre, it **must** be changed by the user immediately and at frequent intervals thereafter.
- (iii) Box Number — the Box Number corresponds to the number of the pigeon hole from which the user may collect output.
- (iv) Memory Allocation — the maximum amount of virtual storage that the user requires to effectively use the system.
- (v) Disk Allocation — the number of cylinders (each 600 Kbytes) of on-line storage required to store the user's files.
- (vi) SQL Units — the number of SQL units (each 512 Kbytes) of storage to be used within SQL.

6.10.3 Cancellation of Inactive Users

When a user cancels his account, the userid is removed and all files associated with that userid are deleted.

6.11 Student Use of VM/CMS

6.11.1 Prices

Student virtual machines running the Conversational Monitor System (CMS) are charged at half internal rates. This means that minimal virtual machines cost

approximately \$60.00 per student per semester (assuming three months access required for a semester).

Further reductions are possible by the supervisor placing a limit on the number of students in a group who may be concurrently logged onto the system. For charging purposes, this is treated as though the total number in the group shared a lesser number (the logged-in limit) of virtual machines with separate mini-disks (and possibly SQL spaces) for each student. For example, if a group consists of 100 student virtual machines each with 1Mb memory and a 1-cylinder mini-disk, but only 25 may be concurrently logged on, then the total charge will be the same as it would be for 25 virtual machines each with 1 Mb memory and four 1-cylinder mini-disks. This arrangement is only available for undergraduate students, and is provided in order to give a level of security from each other which would not be possible using shared machines. Out of consideration for the student, the ratio of limit to group size should normally not be unreasonably small.

6.11.2 Restrictions

- (a) Students may not mount tapes or use special stationery.
- (b) Temporary disk must not be used.
- (c) File retrievals will only be undertaken on request from the subject supervisor and will be charged.

6.11.3 Registration

At the start of each semester, the academic supervisor should register the subject at the Centre's Accounts Desk. The normal *AUTH-UQVM* form specifying virtual machine details and QUBAC accounts to be charged must be provided. Supervisors from Griffith University must also supply a file of student names and numbers. This can be on any of the central systems and should be available from Enrolments.

7. VAX 11/780 SYSTEM

7.1 Introduction

The VAX has been implemented as a low overhead system servicing teaching and research work for the University of Queensland and Griffith University. While use is primarily for students and teaching staff of the Universities, it is available to Administration, support services and non-university clients on application to the Director.

It is a multi-user system with a 32-bit architecture, memory management hardware and virtual memory operating system. The operating system is VAX/VMS (Virtual Address Extension/Virtual Memory System). New users are advised to consult the introductory VAX/VMS manual.

7.2 Software

7.2.1 Languages available on the VAX are:

<i>Language</i>	<i>Reference</i>
BASIC	BASIC Language Reference Manual BASIC User's Guide
COBOL	COBOL Language Reference Manual COBOL User's Guide
FORTRAN	Programming in VAX FORTRAN VAX FORTRAN User's Guide
PASCAL	PASCAL Language Reference Manual PASCAL User's Guide

7.2.2 The commonly-used interactive text editors are:

<i>Editor</i>	<i>Use</i>	<i>Available on KL</i>	<i>Reference</i>
EDT	Screen oriented editor		EDT Editor Manual
SOS	Line oriented editor	✓	SOS Text Editing
TECO	Character oriented editor	✓	PDP-11 TECO User's Guide
QEDIT	Line oriented editor	✓	HELP QEDIT
		(as EDIT)	
SED	Screen editor	✓	HELP SED

7.2.3 Packages include:

<i>Package</i>	<i>Use</i>	<i>Reference</i>
SPSS-X (TM)	Statistical analysis	SPSS-X (TM) Manual Nie Bent & Hull McGraw-Hill
RUNOFF	Text formatting	Digital Standard RUNOFF User's Guide Digital Standard RUNOFF Reference Manual
NAG	Numerical analysis	The NAG Library (Available for reference)
EUNICE	UNIX (TM) environment	UNIX Programmer's Manual

7.3 Configuration

- The VAX has:
- 4 Mbytes of primary memory
 - 800 Mbytes of on-line disk storage
 - 2 x RP06 (200 Mbyte) disk drives for private packs
 - 1 x RL02 (10 Mbyte) disk drive for private packs
 - a TE16 9-track 1600 bpi magnetic tape drive
 - a lineprinter
 - connection to packet switched network (DECnet)
 - connection to circuit switched network (MICOM 600)

7.4 Disk File Allocation

The disk quota allocated to each user is as follows:

<i>Logged In</i>	10000 blocks
<i>Logged Out</i>	1500 blocks

On the VAX, one block is equivalent to 512 characters.

If over quota, the client may delete files to be under quota or remain over quota but pay penalty charges. The client is informed at both login and logout if quota is exceeded.

7.5 Private Secondary Storage

See Section 5.2.

7.6 Backup

See Section 5.3.

7.7 Hours of Operation

See Appendix D.

7.8 VAX Charges

See Appendix H for basic VAX charges, and Appendix F for charges for operator services and consumables.

The VAX is primarily for University teaching and research work and the standard charge rates for that machine are set to compare approximately with the SLOTS rates on the KL. However, because of the difference in architecture and operating systems, costs for any individual job on the KL and VAX may differ. These variations, however, should be marginal.

7.9 Use of the VAX 11/780

7.9.1 Registration as a User

(This section provides information for users of both the VAX 11/780 and the KL10.)

The user must commit funds from a University account to a Computer Centre charge code by completing a *Prentice Computer Centre Order* for computing services, which will establish an expenditure limit for subsequent use. All processing costs will be charged against the charge code. As funds are depleted the user must supply new orders to give the charge code a positive balance to enable work to continue. Information on expenditure on all accounts is sent to departments in the form of monthly statements.

Expenditure on all charge codes is posted to the controlling accounts on a daily basis.

Pads of order forms are available from the University stationery store; for external users, forms may be purchased from the Accounts Desk at the Hawken Service Area. The order form is in duplicate. The copy should be retained by the user department for their records, and the original should be forwarded to the Centre for entry of details. The information on the order form includes the department name, the user name, the official account (for University users) from which funds are to be supplied, and the Computer Centre charge code to which the money is credited.

7.9.2 Identification

Upon registration, a new client is allocated the following items:

(i) *Username*

This identifies the user to the system. It consists of a two character department code and up to ten characters for the name. For example, 'Smith' in Agriculture may have the Username AGSMITH.

(ii) *Password*

The password must be given when logging onto the system as security against unauthorized use. Although it is initially allocated by the Centre, it **must** be changed frequently by the client.

(iii) *User Identification Code (UIC)*

This is a number pair which identifies a user as well as indicating file ownership.

(iv) *Box Number*

The Box Number corresponds to the number of the pigeon hole from which the client may collect output.

(v) *Charge Code*

One Charge Code may have several UICs. For example, clients from a single department doing related work might have individual UICs (to separate their files) all billed to the one charge code. The charges for resources utilized are posted by the system against a charge code.

7.9.3 Expenditure Control

The balance of account which is printed at login reflects the status of the charge code following its last update. The cost of the terminal session (based on prime time rates) is printed on logout with information on CPU time. This amount does **not** include spooling costs. The Centre's account run checks the login time of the session and modifies the charge if necessary.

7.9.4 Cancellation of Inactive Users

The presence of files and accounting entries for inactive users causes an increase in system overheads and may restrict access by other potential users. For this reason, the Prentice Computer Centre regularly monitors usage and may remove inactive users.

All UICs are established with an expiry date which is normally close to Christmas of the current year. A continuing user must arrange for the extension of the expiry date. Periodically, all expired UICs will be removed from the system. When a UIC is removed, whether by request or because of expiry, all files associated with that UIC are deleted.

8. KL10 SYSTEM

8.1 Introduction

The PDP-1099 system is a general purpose system with a diverse range of software. It is used for teaching, research and administrative applications by both Universities as well as by some approved users external to the universities. The operating system is Digital's TOPS-10 7-series with some Computer Centre modifications.

New users should refer to the Introductory Technical Manual MNT-2 *Using the U.Q. PDP-10 System*.

8.2 Software

8.2.1 Languages

A list of languages may be obtained by typing HELP LANGUAGES. The most commonly used languages are listed below, together with cross references to manuals, etc. Other languages (e.g., SNOBOL) that are less frequently used are available and enquiries should be directed to the Program Librarian.

<i>Language</i>	<i>Reference</i>
ALGOL	ALGOL Programmer's Guide ALGOL Programmer's Reference Manual
BASIC	BASIC Manual BASIC User's Guide BASIC Reference Card
C	DOC:SARGAS.DOC
COBOL	COBOL 68 Language Reference Manual COBOL Utilities COBOL Pocket Reference
FORTRAN	FORTRAN-10 Programmer's Reference Manual
MACRO-10	MACRO Assembler Reference Manual DOC:MACMAN.MEM
PASCAL	DOC:PASCAL.MAN
PROLOG	DOC:PROLOG.DOC
SIMULA	SIMULA Manual (Available for reference from the Centre) SIMULA Printout SIMULA Reference Card

8.2.2 Editors

<i>Editor</i>	<i>Use</i>	<i>Available on VAX</i>	<i>Reference</i>
EDIT	Line editor for all terminals	✓	MNT-6 EDIT DOC:EDIT.MEM
EM	A UNIX (TM) editor		DOC:EM.DOC
SED	Screen editor	✓	DOC:SED.MAN DOC:SED.DOC

JRNSED	SED for journalists		HELP JRNSED
SOS	Line and character editor	✓	DOC:SOSUG.MEM
TECO	Character editor available on all DEC computers	✓	DOC:TECO.DOC TECO Programmer's Reference Manual
XTEC	Expanded version of TECO	✓ (as TECO)	DOC:XTEC.DOC PDP-11 TECO User's Guide
VIDED	Screen editor		VIDED.MAN
VISED	VIDED for VS200 terminals		DOC:VISED.DOC

8.2.3 Packages

General Packages which are available include:

<i>Package</i>	<i>Use</i>	<i>Reference</i>
SYSTEM 1022 [®]	Database	1022 Printout (refer to HELP 1022)
ITPS-10	Typesetting	MNT-7 TYPESETTING
QDATA	Data entry	MNT-4 QDATA
RUNOFF	Text formatting	MNT-14 RUNOFF
Plotting Routines	Plotting	MNT-11 Plotting

The Centre supports a large range of scientific and statistical packages for the PDP-10 system. It is recommended that new users of the statistical packages refer to the manual MNT-3 *Statistical Packages on the PDP-10*. The major packages with references are:

<i>Package</i>	<i>Use</i>	<i>Reference</i>
SPSS [®]	Statistical Analysis	SPSS [®] Manual Nie Bent & Hull McGraw-Hill
GENSTAT	Data manipulation and statistics	DOC:GENST.DOC GENSTAT reference manual
IMSL [®] Subroutines	Maths and statistics	MNT-3 Statistical Packages The IMSL Library (Available for reference)
NAG	Numerical analysis	The NAG Library (Available for reference)
STATPACK	Simple interactive statistics	DOC:STP.DOC

A number of packages are available to assist with the use of computers in teaching applications. This is an area of rapid growth demanding co-ordination across the Universities. Intending users of computer-based instruction techniques should in the first instance contact the Dean, Faculty of Education, University of Queensland, or the Director, Centre for the Advancement of Learning and Teaching, Griffith University as appropriate depending on institution.

8.3 Configuration

The PDP-1099 comprises two KL10B processors with:

- 1536 Kwords of primary memory
- 2348 million characters of on-line disk storage
- four 9-track magnetic tape drives
- two high speed lineprinters
- access to HP and Calcomp plotters
- access to Compugraphics MCS8400 phototypesetter

- connection to packet switched network (DECnet)
- connection to circuit switched network (MICOM 600)

8.4 Primary Memory Availability

The amount of primary memory available to individual user jobs varies with time of day:

Prime shift (Mon–Fri)	0800–1730	200 pages
Other times		300 pages

A 'page' here refers to 512 words of memory.

Clients having need of memory beyond 300 pages should discuss requirements with the Operations Manager.

8.5 Disk File Allocation

The public file area must be shared by all users. For operational efficiency, the public area is spread across several drives.

A user is allocated space on one of the public disk areas when an account is established. Disk space is specified in 'blocks'. On this system, one block is equivalent to 640 ASCII characters. The normal limits are:

<i>Logged in</i>	10000 blocks
<i>Logged out</i>	1500 blocks.

Clients who are allocated space on one public disk may gain temporary space while they are logged in by mounting the other public disk. This gives them access to an additional 10000 blocks. This limited amount of on-line file storage is available to each user, as well as a much greater amount of off-line storage, accessible via the *File Migration System*. Clients will help preserve this limited resource by keeping only a minimum working set of files on-line.

8.6 File Migration System

The File Migration System (FMS) facilitates the transfer of files between on-line and off-line (archive) disk areas. There is no limit set on the amount of off-line storage taken by a user but a file storage charge is levied (see Appendix I).

For information on use of FMS, use HELP FMS or print the file DOC:FMSCOM.DOC or refer to Chapter 8 of MNT-2 *Using the U.Q. PDP-10 System*.

ARCHIVE commands are immediately effective, from the client's point-of-view. That is, archived files are moved from the users on-line directory immediately. RETRIEVE commands are processed only during operator-attended running and may take up to two hours to process.

Each January, off-line files not accessed since the beginning of the previous year are removed to tape by the Centre. This is necessary to avoid the off-line storage area becoming so large that the retrieval of files would take an unacceptably long time.

The TDIRECTORY command will list on the terminal the names of your files copied to tape. To retrieve any of these files, clients will need to complete a *File Retrieval Form* and submit it to the Operations Section.

8.7 Private Secondary Storage

See Section 5.2.

8.8 Backup

See Section 5.3.

8.9 Hours of Operation

See Appendix D.

8.10 Use of the KL System

8.10.1 Registration as a User

See Section 7.9.1.

8.10.2 Identification

Upon registration, a new user is allocated the following items:

(i) *Project-Programmer Number (PPN)*

This identifies the user to the system and is also used to differentiate between the new user's disk files and other users' files.

(ii) *Password*

The password must be given when logging on to the system as security against unauthorized use of the PPN. Although it is initially allocated by the Centre, it **must** be changed by the user immediately and at frequent intervals.

(iii) *User Name*

This is usually the user's surname. It is printed together with the PPN on computer output as a means of identification.

(iv) *Box Number*

The Box Number corresponds to the number of the pigeon hole from which the user may collect output.

(v) *Charge Code*

One Charge Code may have several PPNs. For example, users from a single department doing related work might have individual PPNs (to separate their files) all billed to the one charge code. The charges for resources utilized are posted by the system against a charge code.

8.10.3 Expenditure Control

The balance of account, which is printed each time the user logs in, reflects the status of the user's charge code following its last update.

A cost limit which is less than the balance of the account must be specified for the session at each login. This cost limit can be changed during a session.

Charges are accumulated incrementally during the session and when the cost limit is exceeded, the job stops. At this point the interactive user has the option of extending the cost limit (up to the balance of the account) and continuing, or logging off (i.e. terminating the session). A batch job, however, would normally terminate.

If a user does overspend the authorized amount, the charges are payable and the system will not permit the user to log in again on subsequent days until the account is placed in credit by a further order.

8.10.4 Cancellation of Inactive Users

The presence of files and accounting entries for inactive users causes an increase in system overheads and may restrict access by other potential users. For this reason, the Prentice Computer Centre regularly monitors usage and may remove inactive users.

All PPNs are established with an expiry date which is normally close to Christmas of the current year. As the expiry date approaches, the user is warned at every login, and a continuing user must arrange for the extension of the expiry date. Periodically, all expired PPNs will be removed from the system. When a PPN is removed, whether by request or because of expiry, all files associated with that PPN are deleted.

8.11 KL10 Charge Rates

8.11.1 Modifying Factors

System use is charged using base rates which in most cases are modified by various factors. These are:

(i) User Category

Users fall into four groups. These are explained in detail in Section 5.1.

A minimum charge of \$20.00 per month applies to charge codes for clients other than those from the University of Queensland and Griffith University.

(ii) Time of day (Terminal use)

After certain hours, terminal users will be charged at less than the normal rate for terminal work.

Rate Code 3 Normal rate from start of day shift to 5.30pm.

Rate Code 1 40% of normal rate for jobs logged in after 5.30pm.

Rate Code 0 25% of normal rate for jobs logged in during unattended operation.

Charges for line printing consist of two components, a printing charge and a paper charge. The printing charge varies according to the priority the user allocates to that task. Device set-up and assignment and consumable items (e.g. paper) are charged at normal rates at all times.

(iii) Priorities (Batch jobs and Printing)

Batch jobs and printing can be assigned a priority code in the range 1-62. This code determines (with other factors) the order in which the system selects jobs to be executed, jobs with higher codes being given precedence over jobs with lower codes. If no code is specified, the value 10 is assumed as standard. The following table gives the factors by which the standard rates are multiplied, for the priorities used.

Priority Code	Pricing Factor	Nominal Service
1	0.25	Processed at unattended times, weekly turnaround
2	0.25	Weekly turnaround
3- 4	0.5	Overnight turnaround
5- 9	0.7	Better than overnight turn-around — normally finished prior to end of attended running, same day.
10	1.0	One or two hours turn-around depending on load and size of job. The normal priority if a user omits the priority switch.
11-20	1.5	Super Priorities
21-40	2.0	
41-60	3.0	
61-62	4.0	

Notes:

1. For terminal users, priorities are applied to printing operations only.

2. The lowest priority rate does not apply to printing functions. If an attempt is made to use priorities 1 and 2 for printing, the system will automatically change the pricing factor to that for priorities 3 and 4.

8.11.2 *KL10 Base Rates*

See Appendix I. Charges for operator services and consumables are listed in Appendix F.

8.12 *Student Low Overhead Timesharing Service and Student Accounting*

SLOTS (for Student Low Overhead Timesharing Service) provides a relatively low cost teaching service for students requiring computing in many departments. This is achieved largely by minimizing the range of services provided, especially those requiring operator intervention.

8.12.1 *Source of Funds*

SLOTS processing may be funded only from Maintenance, URG and UC Special Research Grants as authorized by the Head of Department.

8.12.2 *Size of Job*

This will be measured by cost and the normal limit is \$3 for undergraduate students and \$6 for postgraduate students. Where particular undergraduate subjects cannot be adequately handled on the basic \$3 limit, the Director may increase the limit to a maximum of \$6 on application by the Head of Department. The same limits apply to batch jobs.

8.12.3 *Restrictions*

The lower charges are possible only by reducing operator overheads and this means that some restrictions apply under the SLOTS system, namely:

- (a) No mounts by operators of magnetic tapes, disks or other media; no special stationery.
- (b) After five minutes of inactivity on a terminal, a warning is given. The job is automatically logged off after a further five minutes, if no action is taken. The automatic logout will be K/B which will delete files off the user area to bring it within quota.
- (c) At logout, temporary files will be deleted.
- (d) Special protections (using FILE DAEMON) are not available on SLOTS. Only normal file protections apply.
- (e) Restoral of files deleted by students is not normally done. Any request for such a service must come from the subject supervisor. File Retrieval charges are applicable.
- (f) No File Migration System.

8.12.4 *Disk File Allocation*

	<i>Logged in</i>	<i>Logged out</i>
During Semester		
Postgraduate students	5000 blocks	200 blocks
Undergraduate students	2000 blocks	100 blocks
Between Semesters		
All users	8000 blocks	400 blocks

The logged out quotas during semester may be increased by the Director to 600 blocks for postgraduate students and to 400 blocks for undergraduate students on application by Head of Department. Postgraduate students granted higher quotas would retain these between semesters.

During peak end-of-semester times, the student disks fill up quickly. In an effort to keep the free disk space at a workable level, it becomes necessary to delete student files not accessed for 21 days. This period may be reduced if necessary.

8.12.5 Use of SLOTS

At the start of each semester, the academic supervisor should register the subject at the Centre's Accounts Desk. An Order authorizing money from an appropriate fund is also necessary.

Supervisors from Griffith University must also supply a file of student names and numbers to set up their accounts. This can be on any of the central systems, and should be available from Enrolments.

Student Accounting

The Student Accounting System provides a means by which the activities and expenditure of student groups may be administered and controlled. The supervisor is allocated the relevant [,100] area from which he controls the project accounts. A student file on the supervisor's area contains account details such as expenditure limits, exercises and number of runs allowed.

To gain access under SLOTS, a student user must identify himself in the normal manner for the system concerned and also supply a valid exercise name or Ident. A student may change his password after logging in by running the program STUPAW.

Postgraduate students can be set up on SLOTS with a unique charge code which is funded from the Department. Special detailed accounting is then not usually necessary.

For more information on student accounting refer to the file DOC:STUPID.MAN.

Cancellation of Student Access

All access is established with an expiry date. The last day of semester is the default expiry date for undergraduate students unless other arrangements have been made by the academic supervisor. Access is cancelled and all files are deleted at the expiry date.

8.12.6 SLOTS Charge Rates

SLOTS charges are one-third the KL base rate for processor time, memory space and file input/output. The time of day does not have any effect on these charges. For the KL base rates, see Appendix I.

9. CONDITIONS OF USE

9.1 PCC Conditions of Use

As a matter of formal procedure, the Prentice Computer Centre offers its services subject to a set of conditions of use and liability. These are detailed in Appendix J and are also printed on the back of a number of forms including orders.

The services may only be used in the manner described in the various manuals and other documentation issued by the Prentice Computer Centre and at the charge rates which apply. The listing of systems software is not permitted except with the approval of the Director.

The Prentice Computer Centre recognizes that no operating system can be made proof against intelligent attack, and monitoring programs are run periodically to ensure that the systems are being used correctly. Should cases be found where a system is not being used in an acceptable manner, this may result in the immediate withdrawal of service and, if appropriate, such further action as the University considers warranted.

These points on conditions of use are raised as a matter of formal administrative procedure. The Centre's attitude is to encourage co-operation between itself and users in order to maintain a first-class computing service on campus.

9.2 Copyright

In addition to the formal conditions of use, computer software is covered by both copyright law and specific licensing agreements for particular programs. The following statement was promulgated by the Australian Vice-Chancellors' Committee to guide computer users in universities on the application of copyright law to computer programs.

- (1) Following on the much publicised dispute between Apple Computer and Computer Edge over the question of copyright protection for computer software, the Federal Parliament passed the Act amending the Copyright Act to make it clear that computer programs are protected by copyright. The amending Act did no more than give statutory effect to the decision of the Federal Court in favour of Apple but it added some additional provisions intended to make the law more certain.
- (2) The Act proceeds on the basis of bringing a computer program within the scope of the expression 'literary work' as used in the Copyright Act. Computer program is defined as meaning:
 - 'An expression, in any language, code or notation, of a set of instructions (whether with or without related information) intended, either directly or after either or both of the following:
 - (a) conversion to another language, code or notation;
 - (b) reproduction in a different material form, to cause a device having digital information processing capabilities to perform a particular function.'
- (3) Subject to what is said below under backup copies, the reproduction of a computer program (as defined) will constitute a breach of the Copyright Act — a position which the Federal Court says was always so.

- (4) The Act also prohibits the making of what is termed an 'adaptation' being one of the exclusive rights given to the owner of the copyright in a literary work. In relation to a computer program an adaptation is defined as:

'a version of the work (whether or not in the language, code or notation in which the work was originally expressed) not being a reproduction of the work'.
- (5) This definition is intended to prevent persons purchasing a computer program in one language and converting it to another language *without the consent of the copyright owner*. It is this last qualification that will apply in most cases in which universities are concerned with the use of computer programs. If it is apparent to all the parties involved in the purchase of a program that its use will, of necessity, involve an adaptation of the work (as defined), the agreement to purchase will carry with it an implied right to make the adaptation. If, however, there should be any doubt about this fact, it would be desirable for the agreement to purchase the program to make express mention of the fact and ensure that the university is authorised by the owner of the copyright in the program to deal with it in the appropriate fashion.
- (6) The Act makes specific provision for the making of a backup copy of either or both the original or an adaptation of a computer program. This right is made subject to the reproduction being made by or on behalf of the owner of the copy of the program from which the reproduction is made. Thus a university can only make backup copies of programs that it owns. If a program is on loan or has been hired, the right to make such copies will have to be expressly authorised by the copyright owner. In addition, the reproduction may only be made for the purpose of being used in lieu of the original copy in the event that the original copy is lost, destroyed or rendered unusable. Such a backup copy cannot be made from an infringing copy of the computer program or where the owner of the copyright in the program has given an express direction to the contrary.
- (7) The Act does not deal with the case of a program being reproduced at a number of terminals that are connected to a main terminal for teaching purposes. If it is intended to use a program in this way, the right to do so will have to be expressly obtained from the copyright owner either at the time of purchase or subsequently.
- (8) Finally the amending Act makes it an offence to publish an advertisement for the supply in Australia of a copy of a computer program if the person believes that the copy is an infringing copy.
- (9) As stated previously, the amending Act is not intended to make any substantial change to the existing law. It is intended only to clarify the present position and universities should, in general terms, feel free to continue existing practices unless those practices run counter to the matters set out above."

In addition to the above, it should be recognised that most software used within the University is obtained subject to a licence agreement which may further limit the use of the software. For example, the use of versions of UNIX (TM) which have been purchased under an academic licence is limited to teaching and such research as would meet the Academic Board's Guidelines for acceptance of external research grants.

Software developed within the University should always be supplied for use of others outside the University subject to a licence even if no charge is made for the software. A pro-forma licence is available from the Program Librarian.

Please contact the Director if you have any doubts regarding conforming use of software.

10. HISTORICAL BACKGROUND

Early Days

The need for a University to have digital computing facilities to support research and teaching as well as an adjunct to the various administrative functions was recognized in the late '50s and, due principally to the initiative of Professor S.A. Prentice of the Department of Electrical Engineering, a **General Electric GE-225** computer was ordered. In August, 1962, the computer was delivered and installed in the present computer room under the direction of Mr R.E. Kelly, the first Computing Officer of the University. This was the first large-scale computer to be installed in Queensland, and its purchase by the University was only made possible by the support of a number of outside organizations who then recognized the value which computing would have to them and the University, and who were prepared to assist the University financially in purchasing the computer. It is of interest to note that this computer was in regular use until 1976; it was decommissioned on 16th March 1977, and presented to the Queensland Museum.

The newly-established Computer Centre continued under the control of the Department of Electrical Engineering, and from this beginning it continued to grow; equipment was augmented and much was done through courses to expand the application of computers throughout the University and the technical community of the State at large. Formal teaching of Computer Science was initiated through the postgraduate Diploma of Automatic Computation.

Independence

Substantial growth was experienced in use of the GE-225 and, in 1966, when saturation was approaching, planning was under way for its replacement. It might be noted here that, almost since its inception, the Centre has experienced an annual growth rate of around 30% and this despite the vicissitudes that beset University financing! In 1968, the initial **PDP-10 KA10** system was delivered by Digital Equipment Australia and was gradually phased into service. 1969 saw the formal recognition of the discipline of Computer Science by the establishment of a Department of Computer Science, and Professor G.A. Rose was appointed to the inaugural chair of the new department. Control of the Computer Centre was transferred from the Department of Electrical Engineering to the new department.

In late 1969, recognizing the essentially service nature of the Computer Centre as opposed to the functioning of an academic department, the Centre was separated from the Department of Computer Science and established as an independent entity. In November 1972, Mr A.W. Coulter was appointed as Director of the Computer Centre. Funds made available in 1973 allowed expansion of the PDP-10 to realize its full potential. In 1974, the Centre extended the scope of its operations to provide computing facilities and services to the newly established Griffith University sited at Nathan. This year also saw the establishment of a User Service group, giving recognition to a long felt need, and enabling the Centre to do more detailed work for users than was formerly possible.

In recognition of the importance of the role played by Professor Prentice in establishing the Centre, the University Senate in 1975 granted to it the title **PRENTICE COMPUTER CENTRE**.

Expansion and Remote Terminals

1976 saw expansion of the original PDP-10 system to its practicable limit and the installation of several remote batch stations. In the latter part of that year, tenders were called for enhanced capacity, resulting in the commissioning of a **PDP-1090 KL10** machine in March 1978.

In January 1979 there was a network of 170 remote terminals connected to the Centre's PDP-10s.

The growth in demand for computing capacity continued and, in 1981, a **VAX 11/780** computer was installed specifically to support teaching and research applications. In December 1982, the PDP-1090 system was upgraded to a dual processor system, a PDP-1099.

One of the more significant features of computing development since 1978 has been the distribution of computing resources through the installation of personal and mini-computers in Departments and Schools of the two Universities. The Centre established a Mini/Micro Group to support these developments through hardware and software assessment and procurement, software distribution and maintenance, communications facilities, and general assistance to users in the development of teaching and research applications.

With the installation of the second KL10 CPU, the opportunity was taken to reconfigure the network allowing more balanced handling of the increased number of departmental mini-computers.

Data Communications Network

The data communications network was enhanced by the installation of **DECnet** packet switching and **MICOM** circuit switching facilities servicing the University of Queensland and Griffith University. By the end of 1982, there were 500 communications lines connected to the Centre servicing a variety of remote devices at transmission speeds from 300 bits per second to 9600 bits per second. Gateways to external networks were developed, and users were then able, from their terminals, to access and use any of the Centre's central computers, the CSIRO computer, and through the Overseas Telecommunications Commission, services available on computer networks in North America and Europe.

During 1982, a start was made on the installation of ducting, cabling and transceivers on the St Lucia campus to replace Telecom Australia facilities for data communications. This enabled the requirements for higher speed transmission to be met at lower cost.

An experimental Local Area Network (ETHERNET) operating at 10 million bits per second was installed in late 1982.

Diversification

During 1983, the Centre installed a **Computervision CAD/CAM System** — a stand-alone system offering very advanced facilities for computer-aided design. The printing services were extended in the middle of the same year by the inclusion of a **Compugraphic MCS 8400** phototypesetting facility. A large range of fonts was chosen to provide phototypesetting capabilities for a wide variety of disciplines.

Telecom Australia at this time was conducting exhaustive testing of its packet switched network **AUSTPAC**. Electronic mail and file transfer facilities were now available to a large number of overseas hosts. The Centre developed a gateway to **AUSTPAC** which allowed a number of users to simultaneously access overseas networks via a connection of 4800 bps which made very fast type-out possible.

1984 and the IBM 3083E

With the KA10 system now 15 years old, and a growth in demand for central computing services for the University of Queensland and Griffith University, detailed investigations into a suitable new system were carried out. As a result, an **IBM 3083E** system was purchased, and released for general use in May, 1984. This powerful new machine introduced the 'virtual machine' concept to the Centre, and broadened the scope of applications and methods of execution.

By the middle of 1984, provisions for plotting had been upgraded. Each University had an HP7475, and the Prentice Computer Centre also had the larger HP7585 and a CALCOMP 936. The CALCOMP 565 was phased out.

Engineering Developments

There has been enormous growth in the strength of departmental computing. In 1975, there were 64 terminals and one PDP-11/10, but within three years the number of PDP-11s had grown to 25. By the end of 1985, the area of responsibility of the Distributed Computing group had experienced a surge as there were now over a hundred mini-computers, mainly PDP-11s and a number of VAX machines of various sizes, more than one thousand terminals and several hundred personal computers. The biggest individual system is the Library with its 50 or 60 terminals generating 2.25 million transfers annually.

A new computer, a PCP 11/57, was created by the Centre's engineering section in 1984 by combining a PDP-11/34 UNIBUS system and a PDP-11/73 QBUS system. Departments who took up this option were able to increase their memory size while retaining their investment in UNIBUS peripherals. Departments were also advised of a new opportunity to increase their computing power by purchasing a PDP-11/73 processor which offered a simple upgrade path for some of their existing PDP-11 QBUS systems. The Distributed Computing group assisted with these conversions.

Development continued on the IBM system and its integration into the network. An early step was the provision for transferring files between IBM VM/CMS users and VAX/VMS users. The MICOM 600 Circuit Switch was upgraded in the latter part of 1984 with the installation of new software and hardware allowing for a total of 1100 line-to-port connections, and resulting in easier access for terminals. The decommissioning at the end of 1984 of the KA10, the first time-sharing computer in Queensland, marked the end of an era of computing at the University.

Personal Computers

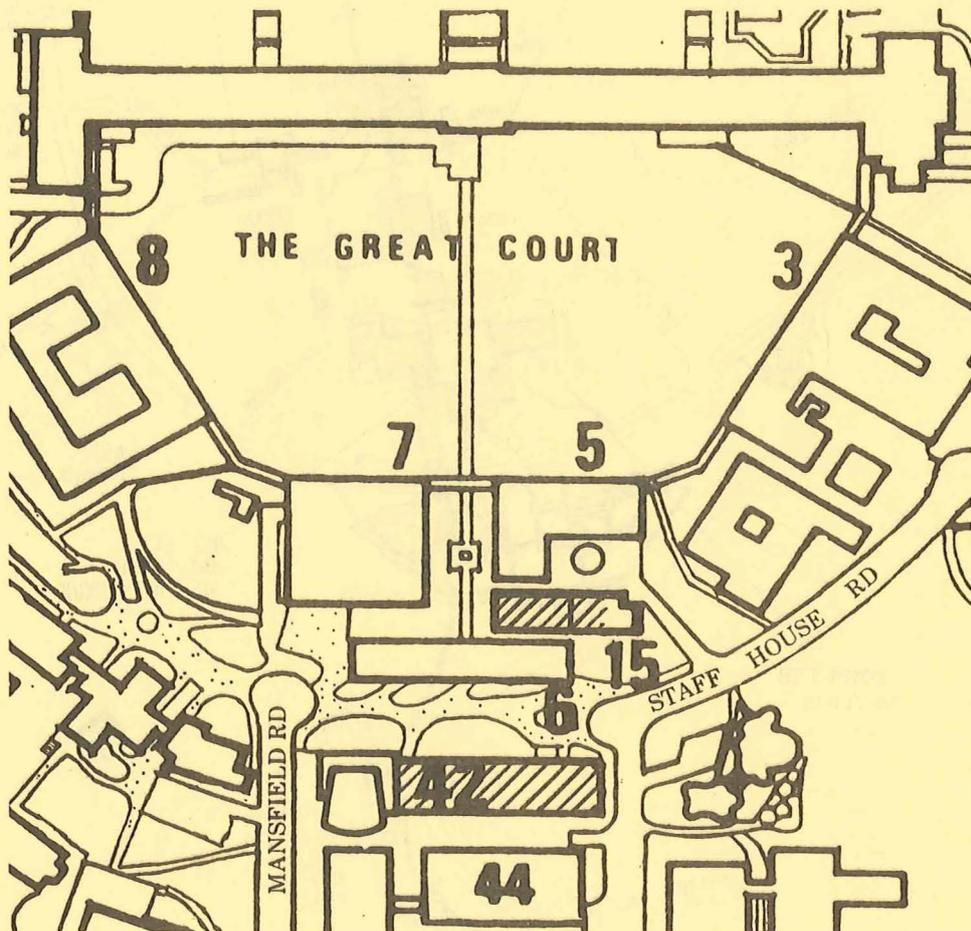
The massive interest in personal computers which developed during the eighties was recognised by the establishment of the Personal Computer Support Centre in 1985. This Centre arranges the sale of personal computers to departments, staff and students of the Universities at competitive prices, and assists users with advice on personal computer problems. Regular courses introduce clients to the use of personal computers, particularly in conjunction with the communications network and the mainframe machines.

New Horizons

The Prentice Computer Centre has always endeavoured to keep abreast of the latest developments in computing and communications technology of relevance to the academic community. In 1986, a laser printer and a very high quality electro-erosion printer will be installed in the Centre. New developments which could assist the teaching, research or administrative work of the Universities are constantly under review with the goal of enhancing the services and facilities of the Centre whenever possible.

APPENDIX A

University of Queensland, St Lucia



Building No. 42
(Hawken Building)

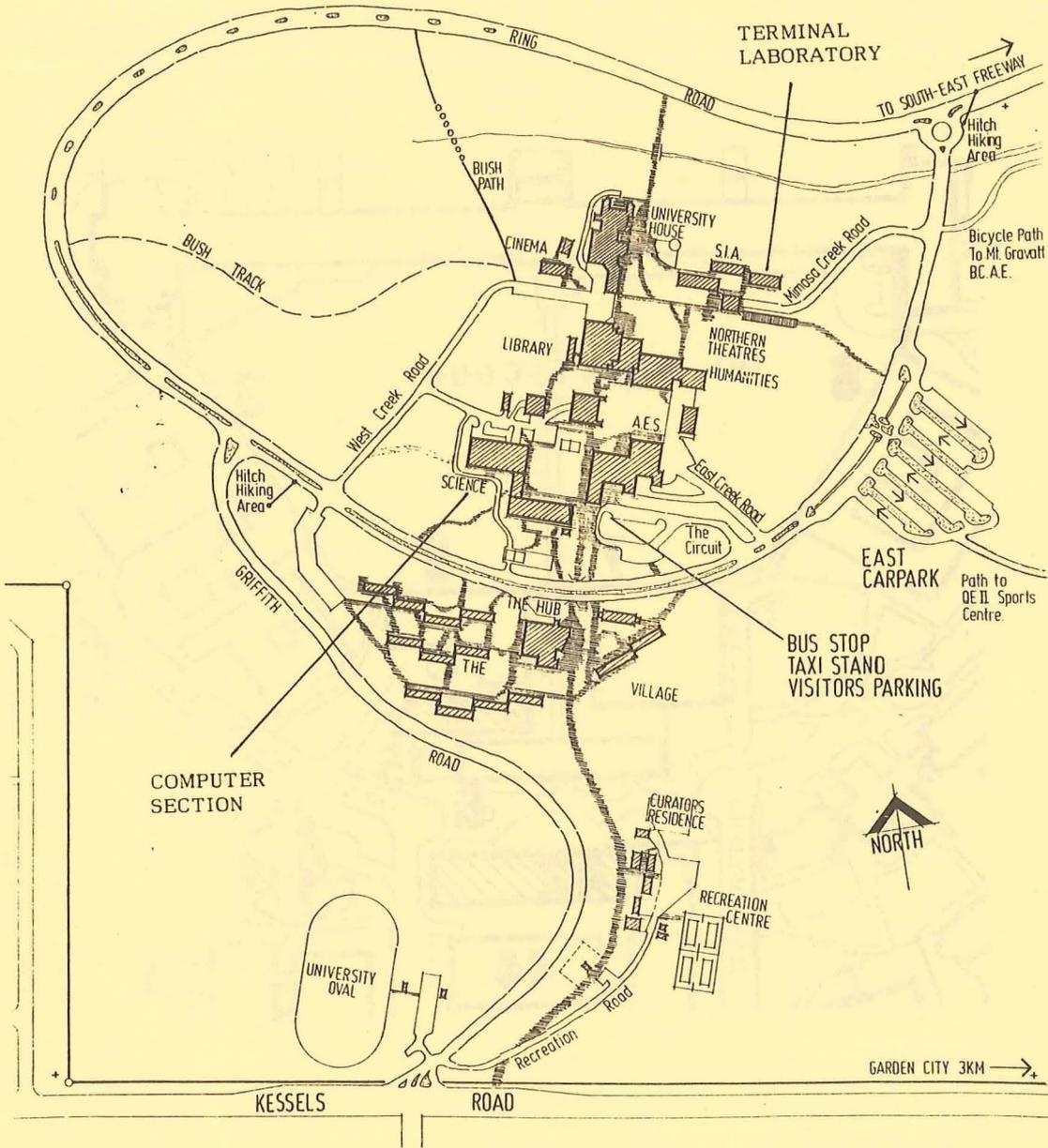
Prentice Computer Centre's central
computing equipment and main offices
(including Hawken Service Area)

Building No. 15

The Centre's teaching area, and the
Engineering and Communications Group

APPENDIX B

Griffith University, Nathan



Science 2 Building
S.I.A. Building

Room - 1.15
Room 1.49,
East Wing

Computer Section
S.I.A.
terminal laboratory

APPENDIX C

Phone Numbers for Enquiries

External users may dial direct by prefixing these extension numbers with 377.

Principal Service Centres	Extension
Contract Programming & Feasibility Studies	3944
System Status Automatic Answering	3101
General Enquiries & Course Enrolments	3018
Training & Courses Information	3021

Service Advice & Problem Reporting	Mail Box	Extension
Central Services HELP Desk (0830-1630)	CCHELP	3025
Program Librarian		3943
Distributed Computing and Network HELP Desk	CCDCHELP	3938
Accounts (0830-1630)		2188
Operations	<i>? Reported Hardware members</i>	3212

Engineering and Maintenance

Development and communications ENGIN ?

Management

Director	2189
Deputy Director	3017
Manager, Applications Development	3944
Manager, Central Computing Facilities	4017
Manager, Distributed Computing	3391
Manager, Engineering and Communications Services	3288
Manager, Finance and Administration	3963

Griffith University

External users may dial direct by prefixing these extension numbers with 275.

Consulting	7796
Computer Services	7560
Computing Co-ordinator	7561

APPENDIX D

Hours of Operation

Operations Counter

General enquiries, receipt and dispatch of work

Hawken Building 0800-2300 Monday to Friday
 Griffith University 0830-1630 Monday to Friday

Accounting enquiries, HELP Desk, Manual Sales

Hawken Building 0830-1630 Monday to Friday

Interactive Computers

Commands for the hours of operation of all systems are —

INFO TIMES on the IBM
 HELP TIMES on the VAX and the KL

Monday	0000-0800	Unattended
	0800-2400	Attended
Tuesday to Friday	0000-0200	Attended
	0200-0800	Unattended
	0800-2400	Attended
Saturday	0000-0200	Attended
Saturday 0200 - Monday 0800		Unattended

MONDAY			TUESDAY-FRIDAY			SATURDAY	SUNDAY
0000	0800	2400	0200	0800	2400	0200	2400

- Attended, all machines available
- Unattended, all machines available except as noted below.

Note: (i) The KL is unavailable from 0645 to 0800 every Monday to Friday.
 (ii) On the first Saturday of every month, air-conditioning maintenance is carried out, and the KL and VAX are unavailable.

Output will be distributed to clients' pigeon holes only during attended hours.

APPENDIX E

Charges for Contract Services

General Contract Services

These are the rates in January, 1986.

Small Jobs

(less than 25 hours)

The **standard rates or charges** referred to in this manual are **\$30 per hour** for minor work. A Prentice Computer Centre *Small Job Requisition* form (available from the University Store) must be tendered for small contracts.

Large Jobs

For larger jobs, the charges are the actual salary costs of the staff involved (based on a year of 220 working days) plus a 25% management fee.

PCC Accounts

Data Preparation

The hourly rate for data entry or verification is \$12.00 for University users and \$24.00 for non-University users.

PCB Design Service

Internal rates \$40/hour
External rates \$100/hour
plus plotting costs.

APPENDIX F

Charges for Operator Services and Consumables

The cost of consumables is constantly changing and charges for such items will vary according to the Centre's buying price. The charges in this appendix are current at the time of writing and are mainly the same for all users. Exceptions are noted.

Operational Services

The charge rates for user requirements in these areas are:

<i>Item</i>	<i>\$</i>	<i>per</i>
Set-up Printer for non-standard stationery	1.50	
Set-up CALCOMP plotter	1.50	
Set-up HP plotter with non-standard carousel	7.50	
Mounting of Magnetic Tape	1.50	
Magnetic Tape Hire (2400ft)	3.00	month
Magnetic Tape Hire (1200ft)	2.00	month
Magnetic Tape Storage	0.50	month
Magnetic Tape Purchase (2400ft)	30.00	
(when available) (1200ft)	20.00	
Mounting of Disk Pack	1.50	
Disk Pack Hire — RP03	20.00	month
— RP06	not available	
Disk Pack Contribution for 3 year lease — RP03	400.00	
— RP06	1000.00	
Retrieval of File(s) from backup by Centre	5.00 minimum	

Line Printing

<i>Stationery type</i>	<i>Cost per page (\$)</i>
Standard	0.045
2-part	0.080
3-part	0.138
4-part	0.123
Continuous A4 Bond	0.066
Labels (3 across, 8 down)	0.1738
Labels (1 across, 12 down)	0.133

Note: On the KL10, a component of the printing charge varies according to priority.

Electro-erosion Printer

Charge rates for this printer will be published in the Computer Centre Newsletter at the time of installation in 1986.

Laser Printer

Charge rates for this printer will be published in the Computer Centre Newsletter at the time of installation in 1986.

HP Plotting Stationery

Cost per page shown in dollars.

<i>Type of Paper</i>	<i>Paper size</i>				
	A0	A1	A2	A3	A4
Drafting/Tracing	2.64	1.32	0.66	0.36	0.20
Heavy	2.05	1.02	0.56	0.28	0.18
Normal	1.90	0.94	0.48	0.24	0.12

CALCOMP Plotting Stationery

\$1.50 per metre.

Letter Quality Printer

The basic charge for using the printer is \$2.00 per hour or part thereof. Prices for consumables are —

<i>Item</i>	<i>\$</i>
Cloth ribbon	13.90
Carbon ribbon	12.50
Print wheel	12.40

Typesetting

The charges for University users are:

Normal 0.5 cent per mm of set type

High priority requests attract an additional levy of \$4.50 per job.

For other users, the rates are twice those for University users.

Telephone Direct Connect Modems and Dial-up Lines

The hire charges to University users for a direct connect modem (charges for terminal and modem combined are shown in parentheses) are:

Half-day (0900-1245 or 1300-1645)	\$4.00 (8.00)
Overnight (1700-0845)	\$4.00 (8.00)
Day (0900-0845)	\$6.00 (12.00)
Weekend (1700 Friday to 0845 Monday)	\$9.00 (18.00)

Failure to return equipment by the specified time will result in an additional charge being levied.

The rates for other users are twice those for University users.

Dial-up modem numbers	300 bps line	377 2977
	1200 or 2400 bps line	377 2922
	1200/75 bps line	377 2655

For bookings, phone extension 3024, or 377 3024 if you are ringing from outside the University.

APPENDIX G

Charge Rates for IBM 3083E

Clients on the IBM 3083E pay a fixed monthly amount based on —

- (i) memory size
- (ii) amount of on-line disk storage.

The base rates for University users are shown below.

The standard charge factors apply for other categories of users (see Section 5.1).

Charges for Memory

The following table provides representative charges but it is possible to obtain memory after the first 1Mb in 4Kb increments:

Mb	\$ per month
1.0	35.00
1.5	127.08
2.0	240.00
3.0	509.17
4.0	820.00
5.0	1161.82
6.0	1528.33
7.0	1915.38
8.0	2320.00

Charges for On-line Disk Storage

Disk storage is allocated in two ways —

- Mini-disks (600 Kbytes per unit) and
- SQL database space (512 Kbytes per unit).

Storage can be provided in increments of one storage unit. Examples of charges are as follows —

Units	\$ per month
1	4.50
2	8.65
3	12.52
4	16.18
5	19.66
10	35.26
25	73.66
50	127.45
100	221.59
250	467.74
500	834.10
1000	1503.18

Charges for operator services and consumables are listed in Appendix F.

Discount a survey for 1-5 MB virtual machines

APPENDIX H

Charge Rates for VAX 11/780

Base rates for work processed on the VAX are:

<i>Item</i>	<i>\$</i>	<i>per</i>
CPU Time	1.20	minute
File I/O	0.00055	transfer (one or more blocks)
File Storage	0.20	1000 blocks per day (up to quota)
	2.00	1000 blocks per day (over quota)
Plotting (HP7475)	0.04	minute
Plotting (HP7585)	0.08	minute
Plotting (CALCOMP 936)	0.08	minute

Note that overquota file storage charges are 10 times normal charges. *Review*

Clients to whom the Intermediate rate applies are charged at 5 times the above base rate, while the External rate is 9.9 times the base rate. See Section 5.1.

For teaching and research work performed between 10pm and 8am, the CPU and File I/O rates are 50% of normal rates. If, however, a job continues through one of these time barriers, the entire job will be charged at the higher rate.

Charges for operator services and consumables are listed in Appendix F.

APPENDIX I

KL10 Base Rates

In most cases, these base rates are modified by a number of factors. Please refer to Section 8.11.1. The charge factors applied to each user category are detailed in Section 5.1.

<i>Item</i>	<i>\$</i>	<i>per</i>	<i>Varies with:</i>		
			<i>User Category</i>	<i>Time of Day (Rate Code)</i>	<i>Priority</i>
Processor Time	3.30	minute	Yes	Yes	Yes
Memory Space	0.414	Kwords per minute	Yes	Yes	Yes
File I/O	0.425	1000 blocks	Yes	Yes	Yes
File storage (on-line)	0.20	1000 blocks per day	Yes	No	No
File storage (off-line)	0.025	1000 blocks per day	Yes	No	No
Plotting (HP 7475)	0.04	minute	Yes	No	No
Plotting (HP 7585)	0.08	minute	Yes	No	No
Plotting (CALCOMP 936)	0.08	minute	Yes	No	No
Connect time (Disk Drive)	4.00	hour	Yes	Yes	Yes
Connect time (Mag Tape)	3.00	hour	Yes	Yes	Yes

The most important factors to consider are the time-of-day and priority rates which can give significant cost reductions if used intelligently.

Charges for operator services and consumables are listed in Appendix F.

APPENDIX J

Conditions of Use and Liability Statement

The following conditions of use are the conditions of the contract constituted by the University's acceptance of the order on the face hereof.

1. In these conditions
 - (i) 'user' means a person who orders work.
 - (ii) 'financial delegate' means the person, whether a member of the staff of the University or not, who accepts responsibility for the payment for work.
 - (iii) 'work' means each job undertaken by the University in fulfilment of the order on the face hereof.
2. The University shall be under no liability for breach of contract or in part or as to any matter or thing of whatsoever nature arising out of or in connection with its undertaking work, save and except as provided in these conditions, and in particular and without limiting the generality of the foregoing, the University will not in any circumstances be liable for any incidental or consequential damages of any nature or kind whatsoever.
3. The user and financial delegate each acknowledges that no warranty, condition or representation on the part of the University has been given or is to be implied from anything said or written between the parties or their representatives or contained in any publication of the University or the Prentice Computer Centre, and any warranty, condition or representation, including but not limited to any warranty, condition or representation as to the liability of the University is hereby expressly excluded.
4. The University will instruct all personnel engaged in the Prentice Computer Centre that they must protect the confidentiality of information and material furnished by users but shall be under no liability whatsoever in the event of any improper disclosure by such personnel.
5. The University will be under no liability for any loss or damage resulting from or in connection with delay in proceeding with or completing work.
6. Work is undertaken by the University on the condition that the user warrants that the work can be performed without the infringement of any patent or breach of any copyright.
7. The user acknowledges in relation to software products supplied to the University under licence (e.g., Calcomp, SPSS, IMSL) that the Prentice Computer Centre may disclose such external and interface details of such software as may be reasonably necessary to their proper use only on condition that the user agrees that the software products or any part thereof are the property of the supplier and are proprietary to the supplier and that the user shall hold the software products or any part thereof in confidence for the supplier. The user agrees accordingly.

8. The user shall within fourteen (14) days of the completion of the work notify the Director of the Prentice Computer Centre in writing of any error resulting or alleged to have resulted in incorrect or lost results. Except for any error so notified, the work shall be deemed to have been accurately and correctly performed.
9. Subject to paragraph 8, where notification of error has been received and it is established that a notified error has caused incorrect or lost results, the University will undertake a re-run of the work at no extra charge, provided that a re-run is reasonably practicable. In the event that a re-run is not reasonably practicable the University will refund to the user an amount not more than the amount paid by the user to the University as the cost of the run in which the error was detected but shall be under no other or greater liability.
10. If a notification is in respect of an error attributable to a fault which has been reported by the University in any of its Prentice Computer Centre publications or by written memorandum to the user, or is attributable to failure by the user to conform with the procedures set out in the appropriate supplier's software manuals with such additions as are notified from time to time by the University in Prentice Computer Centre publications, or by memoranda to the user, the University will be under no liability to re-run or make any refund in respect of that error.
11. The University shall be under no liability to re-run or allow credit where an error in results has resulted from an error of judgement or interpretation by Prentice Computer Centre personnel.
12. The University will be under no liability to re-run or allow credit for any loss resulting from the failure of the user adequately to safeguard himself against the possibility of loss of information within the Prentice Computer Centre systems.
13. Without limiting the effect of any of the above conditions, if any material furnished by the user is lost, destroyed or damaged as a result of neglect on the part of personnel employed in the Prentice Computer Centre or breakdown or fault in the machinery, and the user provides the University with all source information in machine readable form necessary to make restoration of that material reasonably practicable, the University will restore the material.
14. Nothing in the above conditions will require the University to accept any liability or undertake any re-run when incorrect results, loss of results or material, or destruction of or damage to material occur as a result of or in connection with the use by the user of other than the supported facilities notified from time to time in Prentice Computer Centre publications, or the use of supported facilities in other than the manner approved by the University.
15. The user and financial delegate jointly and severally hereby agree to indemnify and forever save harmless the University and each and every member of its staff against all actions, claims or demands for infringement of patent or breach of copyright which may be brought or made against the University or any such member of its staff arising out of or in connection with the performance of the work.

APPENDIX K

Network Schedule of Charges

The schedule of charges is being revised, and the detailed changes will be published as soon as possible.

Advice on the current charging situation can be obtained by contacting the Manager, Engineering and Communications.

APPENDIX L

Network Configuration

UQNET in brief

Communications Network Facilities

University of Queensland

Griffith University

September 1985

**Prentice Computer Centre
University of Queensland
St Lucia QLD 4067**

Communications Addresses

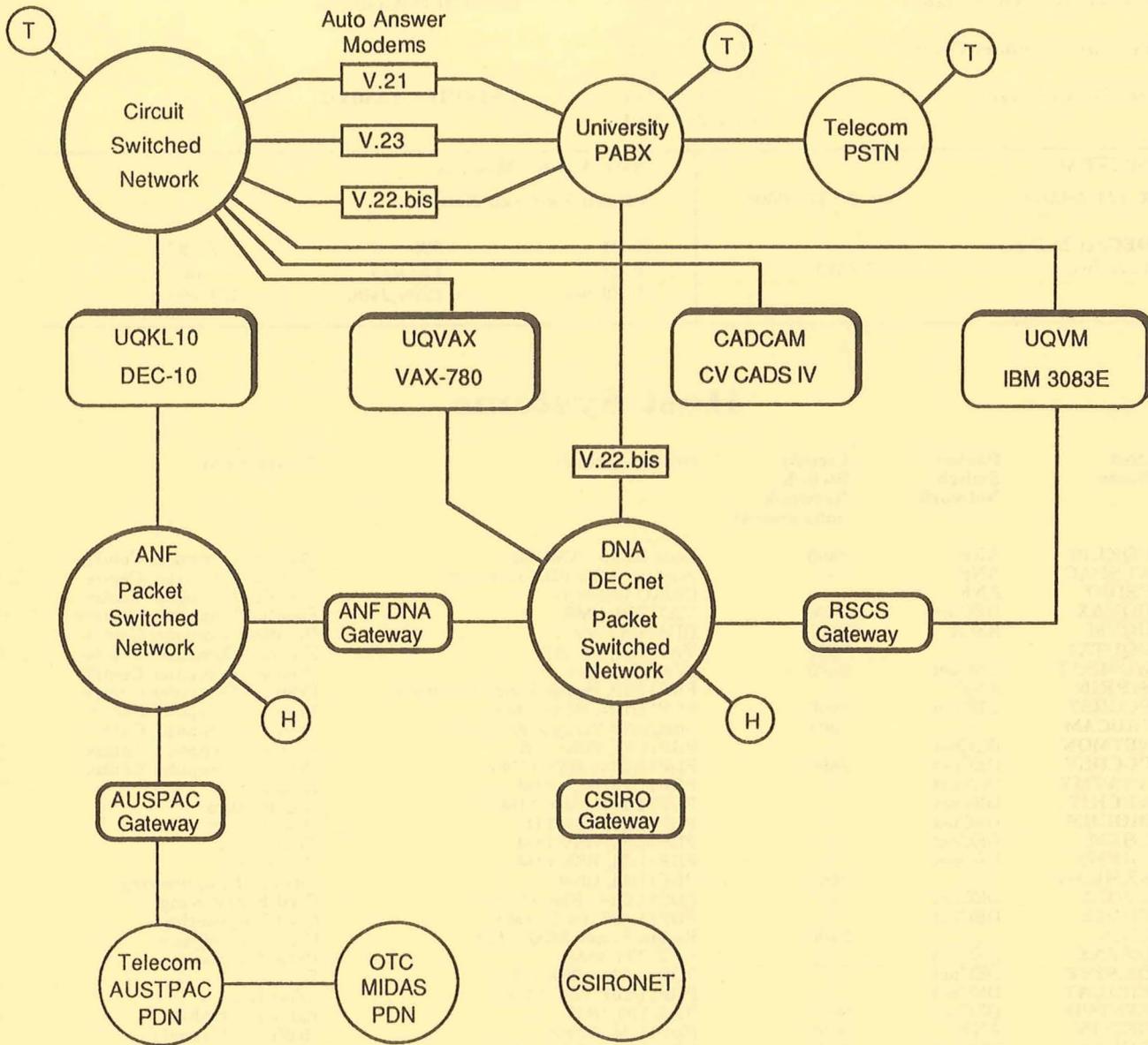
	Telephone	Telex
University of Queensland	(07) 377 1111 + 61 7 377 1111	UNIVQLD AA40315
Prentice Computer Centre	(07) 377 3018 + 61 7 377 3018	
Griffith University	(07) 275 7111 + 61 7 275 7111	UNIGRIFF AA40362

		Auto Answer Modems	
AUSTPAC			
X.121 Address	505 2 737 20000	Circuit Switched Network	
DECnet Dial-In		V.21	300
V.22.bis	377 4065	V.23	1200/75
		V.22.bis	1200,2400
			377 2977 na 377 2922

Host Systems

Host Name	Packet Switch Network	Circuit Switch Network (max speed)	System Details	Department
UQKL10	ANF	2400	Dual KL10, TOPS10	Prentice Computer Centre
AUSPAC	ANF	—	Austpac X.25 PDN Gateway	Prentice Computer Centre
CSIRO	ANF	—	CSIRO Gateway	Prentice Computer Centre
UQVAX	DECnet	2400	VAX 780, VMS	Prentice Computer Centre
UQVM	RSCS	9600	IBM 3083, VM	Prentice Computer Centre
UQUTX1	—	9600	VAX 750, ULTRIX	Prentice Computer Centre
WOMBAT	DECnet	9600	μVAX I, μVMS	Prentice Computer Centre
S4PRIN	ANF	—	PDP11/10, Spooled Serial Printers	Prentice Computer Centre
PCCRSX	DECnet	9600	PDP11/107, RSX-11M+	Prentice Computer Centre
CADCAM	—	1200	Computer Vision CADD5 IV	Prentice Computer Centre
NETMON	DECnet	—	PDP11/23, RSX-11M	Prentice Computer Centre
PCCDEV	DECnet	9600	PDP11/23+, RSX-11M+	Prentice Computer Centre
ANATMY	DECnet	—	PDP11/23, RSX-11M	Anatomy
ARCHIT	DECnet	—	PDP11/23+, RSX-11M+	Architecture
BIOCHM	DECnet	—	PDP11/23, RSX-11M	Biochemistry
CHEM	DECnet	—	PDP11/34, RSX-11M	Chemistry
CHEM2	DECnet	—	PDP11/34, RSX-11M	Chemistry
KEMENG	—	9600	PDP11/44, UNIX	Chemical Engineering
CIVIL1	DECnet	—	PDP11/23+, RSX-11M+	Civil Engineering
CIVIL2	DECnet	—	PDP11/107, RSX-11M+	Civil Engineering
UNIX	—	2400	Perkin Elmer 3200, UNIX	Computer Science
DPVAX	DECnet	—	VAX 730, VMS	Data Processing
DENTST	DECnet	—	PDP11/23+, RSX-11M+	Dentistry
EDUCAT	DECnet	—	PDP11/107, RSX-11M+	Education
EXSTUD	DECnet	9600	VAX 750, VMS	External Studies
GRIFIN	ANF	9600	PDP11/34, DN82	Griffith University
GUDATA	DECnet	9600	PDP11/23+, RSX-11M	GU Data Entry
GUSIA	DECnet	2400	PDP11/23+, RSX-11M+	Griffith University SIA
GUBEAM	DECnet	2400	PDP11/23+, RSX-11M+	GU Science Laser Lab
GUCIS	—	9600	VAX 750, ULTRIX	Griffith University CIS
UQLIB1	DECnet	—	PDP11/107, RSX-11M+	Library
UQLIB2	DECnet	—	PDP11/44, RSX-11M+	Library
MATH	—	9600	Zilog, UNIX	Mathematics
PHARM	DECnet	—	PDP11/34, RSX-11M	Pharmacy
PHILOS	—	2400	ALTOS, UNIX	Philosophy
PHVAX	DECnet	—	VAX 750, VMS	Physics
QIMR	DECnet	—	PDP11/34, RSX-11M	Qld Inst of Med Res

Network Configuration September 1985



Legend With Compliments
H Hosts (see table)
T Terminal Device
PSTN Public Switched Telephone Network
PSN Packet Switched Network
PDN Public Data Network X.25

Trademarks
 AT&T UNIX
 DEC ANF, PDP11, VAX, VMS, DNA
 ULTRIX, DECnet
 IBM VM, CMS, RSCS

Circuit Switched Network

- Asynchronous access by direct or dial-in lines on or off campus.
- See table for hosts available.

ANF Packet Switched Network

(Advanced Network Features DEC-10 Systems)

- Terminal access to ANF hosts and through Gateways to Public Data Networks.
- Program to program communication between ANF hosts or to any DECnet host.
- Remote device access from hosts to card readers, printers, plotters or special I/O devices.
- Spooled serial printers with output from ANF or DECnet hosts.
- Spooling from ANF hosts to DECnet hosts.
- File transfer between ANF and DECnet hosts initiated from either network.
- Electronic mail between ANF and DECnet VAX/VMS hosts.

DNA DECnet Packet Switched Network

(Digital Network Architecture PDP11 & VAX systems)

- Available for DEC PDP11s running RSX-11M or 11M+ and VAXes running VMS or ULTRIX.
- Virtual terminal access between any DECnet hosts or through DNA/ANF Gateway to ANF hosts.
- File transfer between any DECnet hosts and through DNA/ANF Gateway to ANF hosts.
- High speed mass data transfer via Ethernet at 10 Mbits/sec.
- Program to program communication between any DECnet hosts.

Network Functions

- Electronic Mail between VAX/VMS hosts and ANF hosts.

RSCS Network

(Remote Spooled Communications Services)

- File transfers between VAX/VMS and VM/CMS (initiated from source host only).
- Electronic Mail between VAX/VMS and VM/CMS.

KERMIT for Personal Computers

- Terminal access to and file transfer between any ANF, DECnet or IBM host.
- Access route by *any* asynchronous direct or virtual path at speeds up to 2400 bps.

CSIRONET

- Terminal access to CSIRONET hosts from DECNET hosts and via Gateways.
- Terminal access from CSIRONET host to ANF and DECnet hosts.
- File transfer to/from CSIRONET hosts initiated from UQVAX only.

Campus Data Network

- Provision of on-campus or privately owned data cabling — twisted pair, Ethernet, coaxial cable baseband and broadband systems, optical fibre systems.
- Asynchronous/synchronous line drivers, modems and multiplexers.

Public Data Networks (X.25)

- Terminal access into ANF hosts from PADs both public and privately operated in many countries and Australia wide.
- Terminal access from ANF and DECnet hosts via AUSTPAC Gateway PAD to hosts on many PDNs, e.g. OTC MIDAS, AUSTPAC, UK PSS, USA

TYMENET and TELENET. Altogether some 30 networks in 15 countries.

- File transfer and electronic mail between hosts implementing the UK Coloured Book protocols. This includes most academic and publicly funded research organisations in the UK.

New Features Available Soon

- * Virtual terminal access from ANF hosts (e.g. AUSPAC, CSIRO, UQKL10) to any DECnet RSX or VMS host.
- * IBM SNA network with SNA/DNA Gateway for virtual terminal access, file transfer and program to program communication.
- * IP/TCP Packet Switched Network for UNIX systems.
- * PC networking.

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