Multiple choice

1 C	2 D	3 D	4 B	5 D
6 D	7 A	8 D	9 D	10 C
11 B	12 A	13 D	14 C	15 D
16 B	17 B	18 B	19 B	20 C

Question 21. (20 Marks) Start a new sheet of Writing Paper

(a) The software development cycle is fundamental to the Software Design and Development course.

i) Name in order the FIVE stages of the software development cycle. 2

Defining & understanding the problem

Planning and design of solution

Implementation

Testing and evaluation

Maintenance

ii) Describe why software development can be viewed as a cycle. 1

Work through stages in order and then if system needs to be modified you start from the defining and understanding stage again.

(b) During the first stage of the software development cycle, a Feasibility Study should be carried out

i) Name and describe the FOUR main factors that will determine whether a project is feasible. 4

Budgetary/Economic - During the financial or budgetary feasibility, the system analyst determines whether the solution to the problem is affordable. This will involve a cost/benefit analysis to determine the initial cost of implementing a solution, the recurring costs of maintaining a working solution and the benefits for the organisation or customer.

Operational - The aim of determining the operational feasibility is to analyse whether a solution will be usable by the target customers. The users of the software solution being produced must be able to effectively use, or operate, the program. It is often necessary to train users to enable the solution to be operationally feasible. The costs of this training must be considered in the cost/benefit analysis.

Technical - To determine the technical feasibility, the analyst must find out what hardware and software is currently being used. The analyst then determines whether the hardware and software to build a workable solution exists. If the solution requires the organisation or customer to purchase new hardware or software, this will impact on the financial feasibility. Software development will be technically feasible if the equipment and software to develop a solution exists, is available and is within the capacity of the organisation to acquire.

Schedule/Time - The schedule feasibility takes into account the time frame in which a solution must be developed. To determine whether a program will be achievable within the specified time frame it is useful to use project planning tools such as Gantt Charts. The software developer must be able to achieve deadlines specified by the customer. The solution being developed must be achievable within an appropriate time frame.

ii) If a program is deemed to not be feasible, what are the alternatives available to the programmer and project management team? 1

If the solution is determined to not be feasible, the software developer may choose to explore alternative solutions to the problem or may decide to discontinue with the project. They may also choose to scale down the scope of the project.

(c) As an accomplished programmer, you have been asked to develop a program to extract data from a compiled database that a company has been using for years. Unfortunately, the program does not allow all fields to be exported, and you do not have access to the original source code of the program. You are also asked to develop a new database to replace the old program.

i) Describe how reverse engineering could be used in this situation. 1

The compiled program could be decompiled to produce low level source code. The process is made simpler through the use of CASE tools which may help to provide some structure to the decompiled code. This source code could then be modified and recompiled to allow export access to all fields.

ii) What legal and ethical problems does the decision to use reverse engineering pose? 1

It is legal to decompile the programming code if there is no other way to get the required info from/about the program. It would be faaster and bettter to track down the original developer to try to get an original source code copy of the program. If the company is the sole owner of the database and they had it custom built for them originally (or built in-house), there is not much of an ethical problem. However if the database is quite standard and is used by a lot of companies, the company would only have a licence and would therefore have greater legal and ethical problems.

iii) Which software development approach would be most suitable for the development of a new database? Justify your answer. 1

RAD seems the obvious choice because it would be a fairly standard type of database program. RAD would allow the software developer to integrate a number of standard modules with any custom code required to achieve specific functions required by the organisation. RAD would also allow for te program to developed cheaply and quickly. It could not be end-user as they have asked a software develpoper to do it for them. Would not be structured unless you specified that the company is big and that they require the code to be tight. Prototyping would not be used unless you were developing the program from a stndard sort of package like MS Access...

iv) CASE tools would be ideally suited to the development of the new program. What are CASE tools and how could they be used in this situation? 2

CASE tools - Computer Aided Software Engineering tools allow software developers to automate many aspects of the process of software development. CASE tools are a collection of resources that provide planning, analysis, and design facilities, as well as the ability to automatically generate segments of code. They often provide support for maintenance of software that has been developed.

In this situation they would most likely be used to pull together standard modules of code. They could also be used to produce documentation or carry out testing on the modulkes and the complete system.

v) Name the method of implementation that would allow for the company to gradually move one department at a time over to the new system, while other departments continue using the old system. 1

Phased conversion

(d) As a computer security consultant you have been asked to help Coca-Cola protect their computer system from viruses. Users and the IT department have noticed a significant decline in the processing speed of the computers and internal network.

i) Describe, using a known virus as an example, how computer viruses can be rapidly spread throughout the world. 2

Traditionally viruses have spread from computer to computer through the sharing of floppy disks that are infected. More recently, viruses have spread through the use of email. This has enabled viruses to spread throughout the world very rapidly. The **I Love You** virus (which was first seen in 2000) is passed on as an attachment to email. The email indicates that the attached file called 'I Love You' is a special message from a friend. When opened, the virus attaches itself to system files and changes the name of many files. It uses the host computers email address book to send an infected email to all addresses listed in the address book. When the computer is rebooted, the virus program also searches for passwords and sends them to and Internet site for later use.

ii) How could a computer virus affect the processing speed of the computer? 1

A computer virus could affect the computers speed in a number of ways. One way is that the virus program may take up a lot of processor time actually running the virus. The program may be automatically be open on startup and carrying out tasks in the background while you are trying to do other tasks. Another way is that the virus when initially run may insert extra bits of code into program on the computer so that inefficiencies happen. Alternatively, the virus program developer may have written code which only tries to waste processing time (eg a loop that doesnt achieve anything much)

iii) Describe TWO ways that Coca-Cola could prevent viruses from affecting their employee's computers. 1

Install and regularly update virus checking software on all computers. This will only be effective if the user run the virus scan on all emails and disks used. Educate employees.

Filter emails and attachments received by employees so that the threat of email viruses is greatly reduced.

Use a firewall or something to scan programs being downloaded from the internet.

iv) The computer programs used by Coke may need to be tested at both the program and system levels. Differentiate between these two methods of testing. 1

Program testing test the correct operation of the program and all its modules. System testing is carried out to detect errors at the software/hardware interface, including testing the program in possible operating systems etc.

v) Explain how benchmarking could be used to test whether the computers are operating correctly. 1

Benchmarking could be used to test each system against a known good (uninfected) computer. The same programs could be run and operating speeds recorded and compared.

Question 22. (20 Marks) Start a new sheet of Writing Paper

(a) **A large law firm is facing liquidation due to dwindling profits. To solve their problems, the firm has decided that an Internet presence will help them become more competitive and able to offer a better service. One problem they foresee is that any proposed system will take too long to be approved by the board of directors who are not computer literate.**

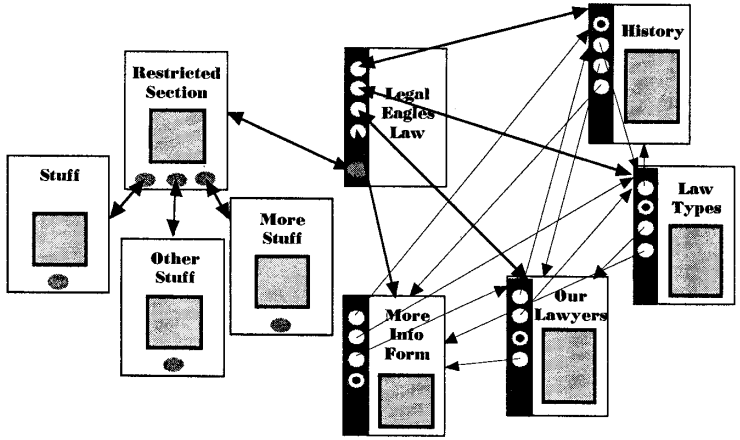
i) Explain why prototyping would be an appropriate development approach for this problem. 1

Prototyping is well suited to program which have a high interface component. Web sites have fairly simple processing with the main emphasis being on the appearance so they are ideally suited to prototyping. Prototyping will also allow the board of directors to be involved in the development and approve the project through it's various stages of development.

ii) Name and describe ONE project management tool that could be used by the board of directors to track the development of the project. 1

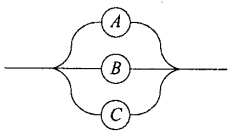
Gantt chart - The project managers and development team could all contribute to a Gantt chart to ensure that tasks are carried out in the timeframes nominated. This keeps the development team accountable and ensures the management don't have unrealistic expectations of what the developers should have achieved in a certain period of time.

iii)Employees and clients will be able to view the firm's web site. A restricted section containing confidential information can be accessed by employees when they are not in the office. Clients can only view information about the business including the firm's history, the types of law practised, and a list of lawyers employed by the firm. Clients can also provide details to receive further information. Draw a story board to demonstrate this system. 2

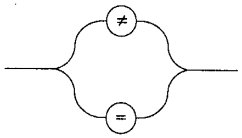


(b) **Part of the syntax of a language is given below.**

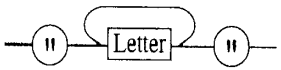
Letter



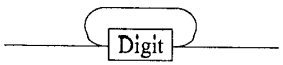
Symbol



Variable



Number



The following assignment statements are syntactically correct in that language.

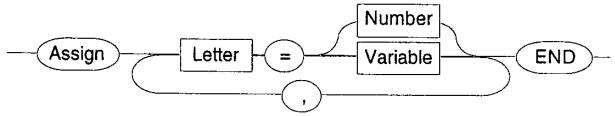
Assign A = "AB" END
Assign B ≠ 5 END
Assign C = "BB", B = 4, A = "B" END

i) Express the syntax of a Variable in EBNF. 1

<variable> = " <letter> {<letter>} "

ii) Draw a 'railroad' diagram for the assignment statement in this language. 3

Assignment statement



iii) In terms of language description, differentiate between operators and operands. 1

operator - The names of actions or functions that are used to carry out an operation. They specify what operation is to be performed on the operands.

operand - The item in an operation which is used to achieve the result. An operand is any sequence of symbols that reduces to a single value. Variables and constants are examples of operands.

(c) **A scientist uses a program which calculates the orbit of planets, speed of rotation and other variables. He notices that there are occasional discrepancies in the results of calculations.**

i) Give an explanation of how these errors may have been caused by the programming code. 1

Could be a rounding error. Precision of storage method (eg 32 bit real or even 128 bit real) may not be accurate enough when alot of calculations need to be performed.

ii) Suggest how the programming code could be improved to avoid such errors in the future. 1

Higher precision variables could be used. Could possibly use BCD (Binary Coded Decimal) as used on mainframes etc - this would allow no rounding.

(d) **A computer program allows the users to type in a sentence terminated by a full stop. After a full stop has been read, the user is given three options:**

1) **Typing U will print out the contents of the array in UPPER CASE**
2) **Typing L will print out the contents of the array in lower case**
3) **Typing T will print out the contents of the array in Title Case (ie the first letter of every word is a capital)**

Theses options are repeatedly available until the user types the letter X to exit from the program. An algorithm attempting to solve this problem is shown below:

```
BEGIN MAINPROGRAM
    length = 0
    REPEAT
        read character
        Sentence[length] = character
        add 1 to length
    UNTIL character = "."
    read choice
    REPEAT
        index = 1
        CASEWHERE choice is
            " U ":  Print UPPERCASE(Sentence[index])
            " L ":  Print LOWERCASE(Sentence[index])
            " T ":  Print TITLECASE(Sentence[index])
        ENDCASE
        index = index + 1
    UNTIL choice = "X"
END MAINPROGRAM
```

i) **Perform a desk check of this algorithm using the test data:**

A qUick TeSt.

U

T

X **2**

length	character	sentence	choice	index	output
0	A	Sentence[0] = A			
1	*space*	Sentence[1] = " "			
2	q	Sentence[2] = q			
3	U	Sentence[3] = U			
4	i	Sentence[4] = i			
5	c	Sentence[5] = c			
6	k	Sentence[6] = k			
7	*space*	Sentence[7] = " "			
8	T	Sentence[8] = T			
9	e	Sentence[9] = e			
10	S	Sentence[10] = S			
11	t	Sentence[11] = t			
12	.	Sentence[12] = .			
13			U	1	
				2	*space*
				1	
				2	*space*
				1	
				2	*space*
				this continues forever	

ii) There are several problems with the algorithm that prevent it from accomplishing the aims described in the problem definition. State the problems with the current algorithm and how they prevent the algorithm from achieving the desired result. **3**

1 - Only lets you enter a choice once so it will be in an infinite loop. The question says they must be able to enter a few different choices

2 - Will only print element 1 from the array - keeps restting index to be 1.

3 - Will not print the first letter as first entry stored in array element 0 but start printing from element 1.

iii) Rewrite the section of the algorithm shown in the box, so that it performs the desired task correctly. **2**

```
REPEAT
    index = 0
    read choice
    CASEWHERE choice is
        "U":  WHILE index < length
                  Print UPPERCASE(Sentence[index])
                  index = index + 1
              ENDWHILE
        "L":  WHILE index < length
                  Print LOWERCASE(Sentence[index])
                  index = index + 1
              ENDWHILE
        "T":  WHILE index < length
                  Print TITLECASE(Sentence[index])
                  index = index + 1
              ENDWHILE
    ENDCASE
UNTIL choice = "X"
```

iv) Design a set of test data that could be used to test that all parts of this algorithm work correctly. Justify the inclusion of the data you have selected. **2**

Sentence	Choice	Reason
A qUick TeSt.		Sentence which is not one of the three options so is clear if it works.
	U	Tests Uppercase
	T	Tests title case
	L	Tests lowercase
	X	checks finishes OK
Try tHiS		No terminating condition so won't work
A qUick TeSt. And some more.		Tests doesn't read in more than one sentence