H2 COMPUTING 9597
GCE A-LEVEL 2014 PAPER 2

1. A supermarket chain wants to encourage customers to return to its store. They operate a scheme of rewards for customers based on how much they spend over a period of time.

   Customers are issued with a card that is readable by a Point of Sale (POS) terminal. When a customer provides their card at the checkout, the system identifies them and stores the products they purchased and how much they spent.

   Currently the only use of this data is to issue the customer with vouchers every three months. Vouchers have a value based on the total amount the customer has spent during the previous three months. The vouchers can only be used in part payment for goods bought in the supermarket.

   The supermarket managers want to make more use of the customer purchase data. They hire a software development company to produce software that will implement new uses of the data.

   Software developers have skills in developing software. The supermarket managers have in depth knowledge of their business. At first, software developers will have little knowledge of the business.

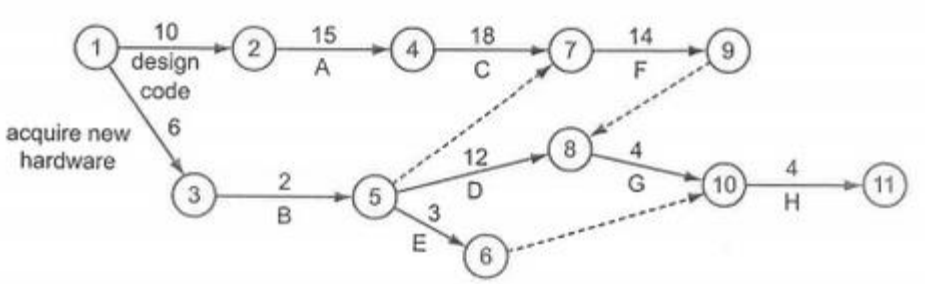
   (a) Explain how the supermarket managers can communicate to the software developers what they require. [2]

   (b) Before designing the new software, the software developers need to understand the content and structure of the customer purchase data.
   Give two methods that can be used for this task, justifying the use of each. [4]

   (c) Once the analysis phase has been completed, describe what decisions software developers need to make before coding can begin. [6]

   The work to implement new uses of the customer data needs to be managed. The following Program Evaluation and Review Technique (PERT) chart is used as a management tool.

   Time is measured in weeks.



(d) Each activity indicated by a dashed line on the PERT chart is a dummy activity.

(i) Explain the nature and purpose of a dummy activity. [2]

(ii) Each of the following activities matches one of the labels A-H on the chart.

- write user documentation
- train users
- write code
- convert files
- test code
- end-user testing
- test system
- install new hardware

Copy and complete the following table,

Label	Activity
A	
B	
C	
D	
E	
F	
G	
H	

[4]

(iii) Explain the significance of the dummy activity that leads into event 8. [3]

(e) From the PERT chart:

(i) State the critical path. [1]

(ii) State the minimum time in which the new software can be developed and implemented. [1]

(iii) The chart omits an activity: **write technical documentation**. State a starting point and a finishing point for this activity. Justify your choices. [4]

Management staff can already access the company network remotely for other software applications. Management are to be given the facility to access, and interact with, the customer data Via the company LAN. However, a decision is made not to allow access to the customer data remotely for this updated system.

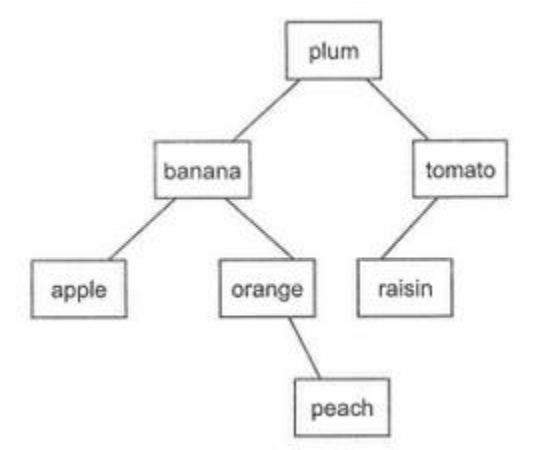
(f) Describe **two** methods which can be used to ensure that there is no remote access to customer data by management staff. [4]

In the new system, customers will have access to information through a web browser. Each customer will be able to see some information about their purchase history.

(g) Explain what software needs to be developed to provide this customer facility. [5]

(h) One of the software developers has the task of ensuring that social issues are considered. This developer has to document these issues.
Describe **two** issues that might be in the document with regard to customers accessing their data. [4]

2. Consider the following binary tree:



(a) List the nodes, in order, that are visited for a post-order traversal. [2]

(b) List the nodes, in order, that are visited for an inorder traversal. [2]

(c) What property is exhibited by the list of items produced in **part (b)**? [1]

(d) Describe an algorithm, using pseudocode, to perform a binary tree search. The output should state whether or not the item is present in the tree. [5]

3. A network manager for a sales company types the following into his computer:

```
copy C:\monthlysales\*.dat E\:\backup\junesales /V
```

(a) State the type of user interface being used. [1]

(b) Describe, using the example, two benefits of the user interface named in **(a)**. [4]

The network manager has a disabled user who cannot use a keyboard but can control a point-and-click device that moves a pointer on the screen.

(c) Describe a user interface that would allow this user to enter text into a word processor. [3]

(d) The sales company provides a special user interface for this user. State **two** benefits to the company. [2]

4. A small local area network (LAN) in a school consists of one switch, one file server and ten computers.

(a) Explain why circuit switching could be used in this LAN. [2]

The network has a connection to the Internet added.

(b) Explain how packet switching is used when a web page is downloaded from the Internet. [3]

A packet from the web server consists of 256 bytes. One of the bytes is the checksum byte. In each byte one bit is the parity bit.

(c) If the byte 0 0 1 1 0 1 0 1 results in a parity error, state the type of parity being used. [1]

(d) The receiving computer uses the checksum byte to check whether the packet contains an error. Explain how it does this. [4]

5. A software developer is given the task of producing software for a college. The software will help to manage information about what students do after finishing at the college.

   The destination of each student after college is classified in one of three possible ways:

   - University
   - Employment
   - Other

   The college wishes to store:

   - name
   - number of A Level passes
   - destination (U / E / O)
   - university attended
   - main subject studied at university
   - type of employment
   - what students do when their destination is classified as 'O'

   The software developer will use an objectoriented approach to developing a solution.

   (a) Draw a class diagram which exhibits the following:

   - suitable classes with appropriate properties and methods
   - inheritance
   - polymorphism

   [6]

(b) Explain how your solution to (a) demonstrates software reuse. [2]

The data on the students is to be stored in a serial text file called STUDENT.DAT. Each line of the file has the same structure:

```
<Name><NoOfPasses><Destination><University><MainSubject><EmpType><Other>
```

with the string NULL stored where appropriate.

(c) Write an algorithm, in pseudocode, to read data from STUDENT.DAT and to output the following:

- total number of students going to university
- average number of passes for the students going to university e total number of students

[7]

6. A function is to be written that returns the sum of all values held in an array that are greater than a minimum value. The function will be used with arrays of varying size, but never more than a maximum of 50 000 elements.

   A first attempt at writing the program code for the function is given below:

```
1.  FUNCTION TotalSum(Results : ARRAY[50000] OF REAL,
                      ArraySize : INTEGER, MinValue : REAL)
                      RETURNS REAL
2.      DECLARE Sum, Counter : INTEGER
3.      DECLARE Temp : Real
4.      Sum = 0.0
5.          FOR Counter = 1 TOO ArraySize
6.              Temp = Results[Counter]
7.              IF Temp > MinValue THEN Sum = Sum * Temp
8.          ENDEOR
9.      RETURN Sum
10. ENDFUNCTION
```

   The function is included in a program specifically written to test the function. The main program outputs the value returned by the function. A compiler was used to compile the source program.

   (a) The compiler reported an error at line 5 in the function. Identify the error and explain why it was flagged as a syntax error. [2]

   (b) The compiler also reported an error at line . State the type of error reported by the compiler justifying your answer. [2]

   The errors indicated in **parts (a)** and **(b)** were corrected. A successful compilation produces executable code. When the code was executed, the program failed to complete and reports an error at line 7.

   (c) (i) State the type of error that occurred. Justify your answer. [2]

   (ii) The error described in **part (c) (i)** depends on the detection of another type of error. Name this other type of error. How should the code be changed to correct this error?[2]

   When the program finally runs without error, the test plan needs to be completed. The test plan uses data that tests different sizes of array, different array values and different minimum values.

   The array `TempArray` is used in the main program as the array to be processed.

(d) Each element of `TempArray` stores a random value between 1.0 and 10.0.

(i) Explain why the function call:

```
TotalSum(TempArray, 1000, 5.0)
```

is not an appropriate black box test. [2]

(ii) Explain why the function call:

```
TotalSum(TempArray, 10, 10.5)
```

is not an appropriate white box test. [2]

(e) If each element of `TempArray` stores the value 1.0, state a function call that will be an appropriate black box test. Justify your answer. [3]