UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

9691 COMPUTING

9691/33 Paper 33 (Written Paper), maximum raw mark 90

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.
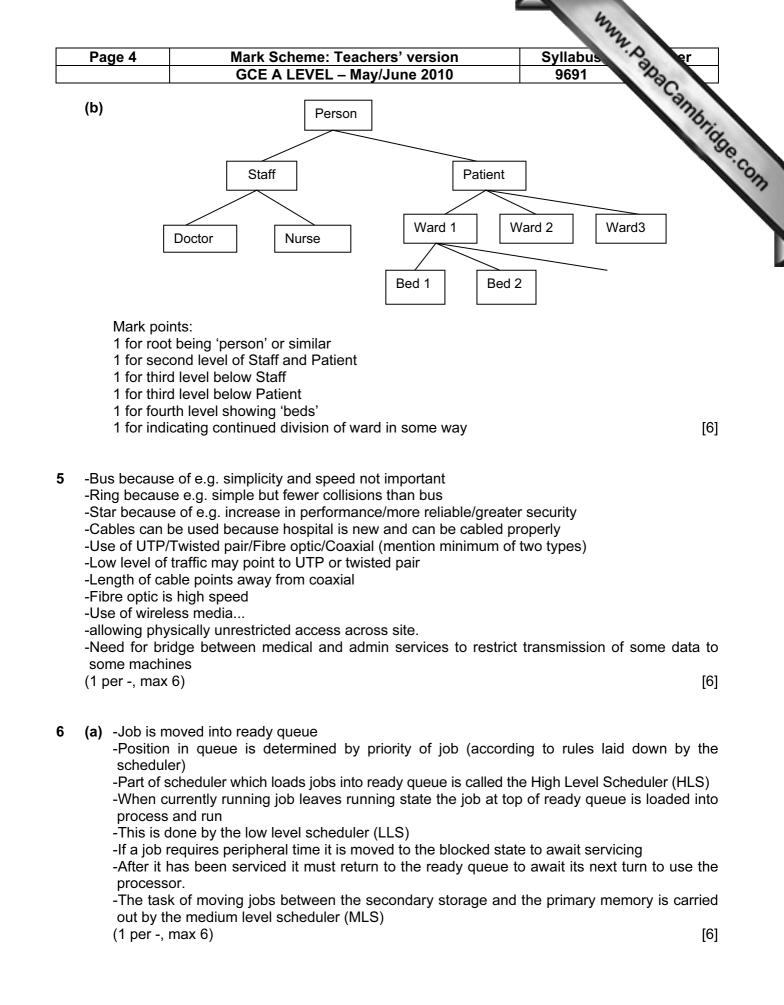
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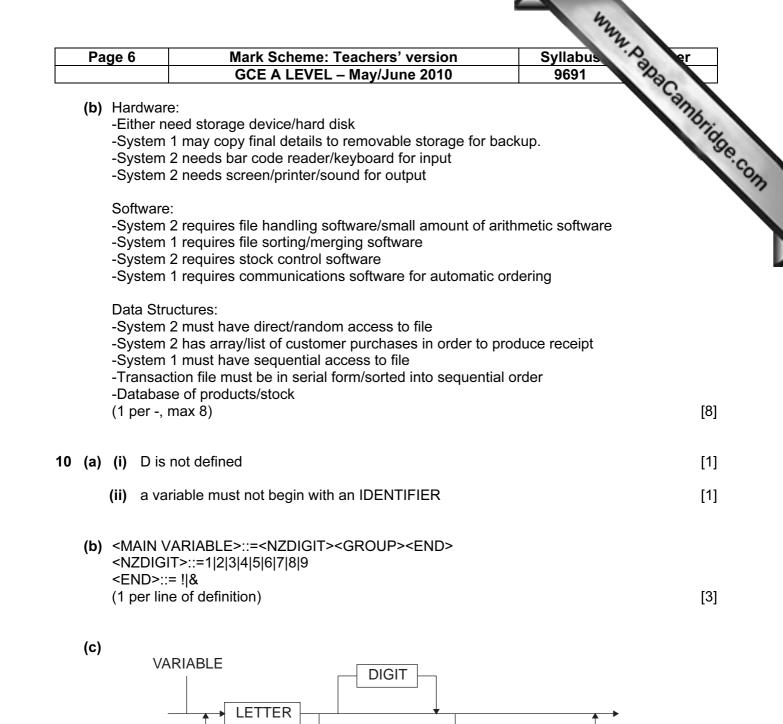
CIE is publishing the mark schemes for the May/June 2010 question papers for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level syllabuses and some Ordinary Level syllabuses.

1   (a) -The lexical analysis stage is a preparation stage of the code/making it ready for tra
          -The syntax analysis stage is a checking stage to ensure that the code is suit
           translation
          -Some error reporting is carried out in both stages
          Lexical analysis:
          -Redundant characters are removed
          -Small groups of characters are tokenised
          -Keywords are given their own tokens
          -Keywords are checked for validity
          -Symbol table is created
          Syntax analysis:
          -Checks the tokens to ensure that strings of them form valid statements by…
          -seeing if the rules of the language are followed
          -An example e.g. Are brackets nested and are there the same number of left and right
           brackets?
          -Symbol table is filled in
          (1 per -, max 6)   [6]

     (b) -Creates a machine code program...
          -which is equivalent to the high level language program
          -The code which is created will not be efficient
          -Optimisation is used...
          -to reduce the number of commands in the object code...
          -by removing redundant code/substituting one command for several (according to set rules)
          (1 per -, max 3)   [3]

     (c) -Copies object code into…
          -(primary) memory ready for execution
          -Deals with addressing anomalies…
          -Particularly relocatable addresses
          (1 per -, max 2)   [2]

2   (a) (i) -Large number of new data items to be added throughout the week
               -Serial file allows the additions to be made at the physical end of the file
               -Other methods would be too time consuming
               (1 per -, max 1)   [1]

          (ii) -Makes searching for a particular employee record easier
               -Allows the file to be used to update the master employee file in one pass/produce the
                payroll
               -To put the file in the same order as the employee records
               (1 per -, max 1)   [1]

     (b) (i) -Read record from A, Read record from B
               Repeat
               -If A<B Then copy A to T and Read next record from A
               -Else copy B to T and Read next record from B
               -Until A or B has no more records
               -If A is empty copy remaining records from B to T
               -Else copy remaining records from A to T
               (1 per -, max 5)   [5]

(ii) -Compare centre record with 21478
  -If no match, half of remaining file is removed
    -If 21478< centre value then remove upper half of remaining records
    -Else remove lower half of remaining records
  -Repeat until 21478 is found
  -Mention of problem if no centre value
  (1 per -, max 5)   [5]

3 (a) -Touch/pressure/weight sensor…
    -to determine when the robot has picked up a control assembly
  -Light sensor…
    -to detect when a light beam has been broken so that the robot knows a washing machine has arrived
  -Pressure sensor to measure torque…
    -to determine when the screw has been adequately tightened
  (1 per -, max 2 pairs, max 4)   [4]

(b) -Paint sprayers
    -arm is programmed to follow a series of actions
    -in predetermined sequence
  -Welders
    -to fix body panels to each other
  -Carrying parts around the factory
  -These applications stop a human having to be in a hazardous environment
  -They ensure a high/consistent standard of work
  -Greater precision in the work
  -They work continually without breaks.
  -Comment about the effect on the human workforce
  (1 per -, max 6)   [6]

4 (a) -Data are held in a tree structure…
  -with each level providing more detail to the data held on a higher level
  -Links to related data items at higher and sometimes lower levels
  (1 per -, max 2)   [2]

(b)

```
                          ┌──────────┐
                          │  Person  │
                          └────┬─────┘
                ┌──────────────┴──────────────┐
           ┌────┴────┐                   ┌─────┴─────┐
           │  Staff  │                   │  Patient  │
           └────┬────┘                   └─────┬─────┘
         ┌──────┴──────┐          ┌────────────┼────────────┐
    ┌────┴───┐   ┌─────┴────┐  ┌──┴─────┐ ┌────┴───┐  ┌─────┴────┐
    │ Doctor │   │  Nurse   │  │ Ward 1 │ │ Ward 2 │  │  Ward3   │
    └────────┘   └──────────┘  └───┬────┘ └────────┘  └──────────┘
                              ┌────┴────┐
                         ┌────┴───┐ ┌───┴────┐
                         │ Bed 1  │ │ Bed 2  │
                         └────────┘ └────────┘
```

Mark points:
1 for root being 'person' or similar
1 for second level of Staff and Patient
1 for third level below Staff
1 for third level below Patient
1 for fourth level showing 'beds'
1 for indicating continued division of ward in some way   [6]

5   -Bus because of e.g. simplicity and speed not important
     -Ring because e.g. simple but fewer collisions than bus
     -Star because of e.g. increase in performance/more reliable/greater security
     -Cables can be used because hospital is new and can be cabled properly
     -Use of UTP/Twisted pair/Fibre optic/Coaxial (mention minimum of two types)
     -Low level of traffic may point to UTP or twisted pair
     -Length of cable points away from coaxial
     -Fibre optic is high speed
     -Use of wireless media...
     -allowing physically unrestricted access across site.
     -Need for bridge between medical and admin services to restrict transmission of some data to
      some machines
     (1 per -, max 6)   [6]

6   (a) -Job is moved into ready queue
          -Position in queue is determined by priority of job (according to rules laid down by the
           scheduler)
          -Part of scheduler which loads jobs into ready queue is called the High Level Scheduler (HLS)
          -When currently running job leaves running state the job at top of ready queue is loaded into
           process and run
          -This is done by the low level scheduler (LLS)
          -If a job requires peripheral time it is moved to the blocked state to await servicing
          -After it has been serviced it must return to the ready queue to await its next turn to use the
           processor.
          -The task of moving jobs between the secondary storage and the primary memory is carried
           out by the medium level scheduler (MLS)
          (1 per -, max 6)   [6]

(b) -IO and processor bound jobs give priority to IO bound jobs
-FCFS
-Round robin or time share systems
-Shortest job first
-Shortest remaining time
-Multi level feedback queues
(1 per -, max 2)　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[2]

7 Advantages:
-Workers can use at any time
-They can be used at home or away from work so work time is not used up
-Worker is not worried about learning with others around
-Do not have to pay for a trainer
-Workers absent for a training session would miss some of training
-Worker is able to redo parts of training that they are not happy with
-Worker can miss out sections that they are already happy about
-Training is to use technology so it is reasonable to learn on the technology
Disadvantages:
-No human to ask when you get stuck on something
-Not all workers have access to a computer on a regular basis
-Worker is having to train in their own time
(1 per point, max 4 advantages, max 6)　　　　　　　　　　　　　　　　　　　　[6]

8 **(i)** -The address of the next instruction
-Content is incremented after the address is read
-Content is altered to specific address if instruction is a jump instruction
(1 per -)　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[3]

(ii) -Stores an instruction...
-while it is being decoded/executed/carried out
-Contents change when an instruction from memory has been placed in MDR, and then it is
 copied from MDR to CIR.
(1 per -)　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[3]

(iii) -Stores an integer value
-Which is added to the base address in the instruction
-Used for the successive reading of values from memory locations e.g. in an array
-Can be incremented after use
(1 per -)　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[3]

9 **(a)** -System1 will be batch processed/as data is collected before processing
-the system outputs are not time critical
-System 2 response time will be immediate/real time
-as the customer must wait until processing is done.
(1 per -, max 3)　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　[3]

(b) Hardware:
-Either need storage device/hard disk
-System 1 may copy final details to removable storage for backup.
-System 2 needs bar code reader/keyboard for input
-System 2 needs screen/printer/sound for output

Software:
-System 2 requires file handling software/small amount of arithmetic software
-System 1 requires file sorting/merging software
-System 2 requires stock control software
-System 1 requires communications software for automatic ordering

Data Structures:
-System 2 must have direct/random access to file
-System 2 has array/list of customer purchases in order to produce receipt
-System 1 must have sequential access to file
-Transaction file must be in serial form/sorted into sequential order
-Database of products/stock
(1 per -, max 8)   [8]

10 (a) (i) D is not defined   [1]

   (ii) a variable must not begin with an IDENTIFIER   [1]

(b) <MAIN VARIABLE>::=<NZDIGIT><GROUP><END>
     <NZDIGIT>::=1|2|3|4|5|6|7|8|9
     <END>::= !|&
     (1 per line of definition)   [3]

(c)

Mark Points:
-Allows single LETTER
-Allows unlimited LETTERs
-Allows single DIGIT and only after LETTERs
-Allows single IDENTIFIER but only after LETTERs (and DIGIT)
(1 per -, max 4)   [4]