UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the October/November 2011 question paper

for the guidance of teachers

9691 COMPUTING

9691/31 Paper 3 (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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

* Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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1 (a) -disk space is organised into allocation units (clusters)
   -FAT is a map of which clusters are used to store which files // Individual sectors on
   are organised into clusters which are used to store the files
   -Details where files are stored on backing store
   -Acts as an index on the hard drive
   -Shows unused/unusable clusters
   (1 per -, max 3)   [3]

   (b) -The boot file contains user-defined information...
   -to tailor the operating system // Contains parameters by which the system will operate
   -boot file stored on backing store/CMOSRAM...
   -read/written to by the boot program (held on ROM)
   (1 per -, max 3)   [3]

2 (a) -Single processor/control unit
   -Sequential processing of program instructions
   -Instructions and data indistinguishable
   -Can be stored together in same memory unit
   -programs can be exchanged/reloaded easily to the same memory unit
   (1 per -, max 3)   [3]

   (b) (i) -Contains the address of the next instruction to be fetched
       -Passes address to the MAR
       -and is then incremented
       -Contents altered to the operand of the instruction is a jump instruction
       (1 per -, max 3)   [3]

       (ii) -Holds the current instruction...
       -divided into the op-code and operand
       -Holds the instruction while the op-code is decoded
       -Sends the address to the MAR.
       -Mark for mention of use of address to alter PC/need for other parts of instruction e.g.
       addressing type used.
       (1 per -, max 3)   [3]

3 (a) (i) –390 = 1110000110

   (ii) –47 = 1000101111
         (1 for both sign bits and 1 each for the magnitude parts)

   (b) (i) +93 = 01011101   [2]

   (ii) -69 = 10111011   [2]
         (in each case 1 mark per nybble)

   (c) (i)   1 1 1 0 0 0 0 1 1 0
              1 0 0 0 1 0 1 1 1 1
              1 1 1 0 1 1 0 1 0 1
                      1 1 1
         =1 1 1 0 1 1 0 1 0 1

         (1 for correct carries, 1 for correct answer (9 bits), 1 for correct msb)   [3]
         f.t.

   (ii)   0 1 0 1 1 1 0 1
           + 1 0 1 1 1 0 1 1
         = 1 0 0 0 1 1 0 0 0
            1 1 1 1 1 1 1 1

         (1 for correct sum, 1 for correct answer (8 bits), 1 for correct carries, 1 for showing
         ignoring ninth bit)   [4]

4 (a) -networked communication system...// content provided by a web server
       -probably provided on the Internet
       -Restricted access...
       -to specific members authorised by the health ministry
       -Access is password controlled
       -Content is webpages / made available from a web server / viewed using browser software
       (1 per -, max 3)   [3]

   (b) e.g.-Limited number of users speeds up access...
       -Information being communicated is sensitive/confidential...
       -needs protection from being seen by unauthorised people
       -Information on system will be relevant/easily updated
       -Less information makes it easier to navigate
       -easier to control who can access the content
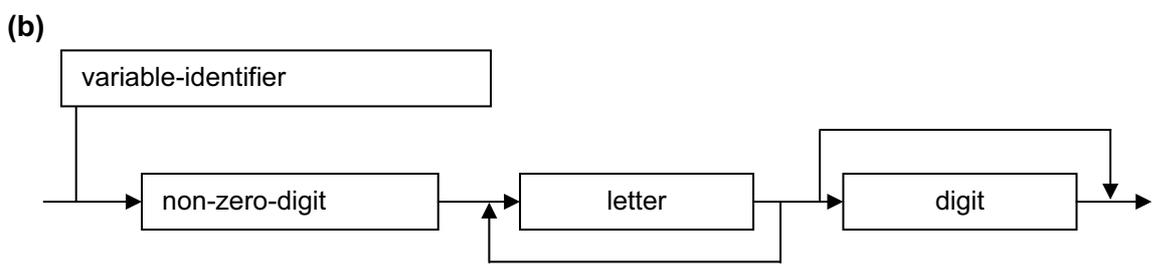   (1 per -, max 5)   [5]

5 (a) E.g. -Touch sensor/pressure sensor/infrared sensor / other sensible
-Needed to tell robot when components arrive // To investigate orientation of compo
anything sensible

E.g. -Actuator (electric motor/stepper motor/end effecter) of some sort
-Needed to move robot arm // to physically interact with component // or anything sensible
-(Speaker/LCD display) conditional on:
-a description of error reporting (2 or 0 marks)
(1 per -, max 4)   [4]

   (b) e.g. -Cheaper, do not need to be paid
-Work 24/7
-Do not require heat, light, space, ventilation, facilities
-robots can work in hazardous environments
-Items/actions produced are all to a consistent high standard // fewer errors
-Reliable/workers can be off work/will never strike
-Actions are more accurate than those of human.
 (1 per -, max 4)   [4]

   (c) -May involve simply changing from one stored program to another
-set new parameters for current program
-edit program/writing new program code
-by physically being moved through intermediate positions …
-…which the system can then replicate
(1 per -, max 3)   [3]

6   -Interrupts have a priority
-on receipt of an interrupt all interrupts of a lower priority are "masked out"/refused
-Contents of registers are placed on stack
-the appropriate interrupt service routine (ISR) is loaded and run
-on completion of the ISR …
- …values read from stack and loaded to registers
-all interrupts are re-enabled
-the interrupted process is resumed

-Mention of use of vectored interrupt to point to code that needs to be run.
(1 per -, max 6)   [6]

7 (a) -A flat file is a datafile with records of the same structure
-A relational database consists of a number of tables that are linked
-flat file may contain redundant/duplicated data

(b) -Reduces repetition/duplication of data items // keeps physical volume of data to a minimum // minimises redundant data
-Increases data integrity // reduces data inconsistency
-(Simpler) data retrieval through queries // reports are easy to generate
-Amending/searching/sorting data is eas<u>ier</u>
-Amending the data structures (e.g. to include wards) is simpler to implement
-Changes to the data structure will not affect existing applications programs // Program/data independence

(1 per -, max 3)   [3]

(c) (i),(ii) -Information on patients is sensitive
-certain data needs to be restricted to certain users
-avoid concurrent updates of the same record

-Patient table can be encrypted
-groups of users can be set up with the same privileges/access rights
-…Which are arranged in a hierarchy
-access rights dictate what the user is allowed to see/do
-Access rights relate to a table/ tables / fields/attributes /queries/reports…
-access rights may determine the HCI provided to the user.
(1 per -, max 5)   [5]

8 (a) (i) -Variable whose scope is restricted to a specific procedure/function/module/block

(ii) -Variable whose scope exists across an entire program

(iii) -procedure call passes the <u>value</u> of the parameter
-local copy of data is used // discarded when procedure finished

(iv) -pointer/address of the parameter/variable is passed
-any changes are retained after returning to the calling code.   [4]

(b) -Return address is stored on stack (before control passed to procedure)
-Values of parameters are placed on stack
-Procedure will read same number of values from stack as parameters it was expecting

-Address can be read from stack and placed in PC
-Nested calls to procedures will be unwound in correct order
-Problems if too many nested calls (unending recursive function) // stack overflow
(1 per -, max 4)   [4]

9   (a)   (i)   -Strings of characters are grouped to form keywords/reserved words
-Checks reserved words for validity
-keywords/Reserved words/identifiers replaced by tokens
-identifiers placed in symbol table
-Unnecessary characters/comments/whitespace removed
-final output is a token string
(1 per -, max 4)   [4]

   (ii)   -the format of instruction/token string is compared …
-… to forms for acceptable expressions and statements.
- as defined by the meta language used
-example of a syntax error e.g. IF THEN x=3
(1 per -, max 3)   [3]

   (b)   (i)   Routines are:
-Already written and can be inserted with a single command word/Saves time in writing code
-many projects require similar code e.g. sorting/searching
-Already tested
-Code is robust and reliable
-should ensure consistency of standards
-Already translated/Makes translation process faster/simpler
(1 per -, max 2)   [2]

   (ii)   -Loader is used to load routine into memory when required
-Ensures no memory conflicts between different routines
-Linker links segments/files of code (to produce executable code).   [2]

10   (a)   (i)   There can only be one <non-zero-digit> before the letter <group>

   (ii)   X is not defined as a <letter>

   (iii)   Only one <digit> is allowed after <group>   [3]

   (b)

Mark Points:
-Only one entry and one exit point used
-Order correct (non-zero-digit, letter, digit)
-Loop around **letter** to create **group**
-Loop around **digit** to create two options one to include final digit, one to omit final digit
(1 per -, max 4)   [4]