UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the May/June 2011 question paper

for the guidance of teachers

9691 COMPUTING

9691/31 Paper 3 (Written Paper), maximum raw mark 90

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UNIVERSITY of CAMBRIDGE
International Examinations

1 e.g.-Data bus
-to carry data from one location to another in processor // e.g. from MDR to CIR

-Address bus
-carries the address of a memory location // e.g. Address of location in memory from MAR

-Control bus
-Carries control signals around processor // to synchronise the operation of the processor components // by example: memory read/write completed // each line carries a different signal.
Accept: system bus, memory bus, firewire, USB, PCI + explanation
(2nd mark is dependent on correct bus name)
(2 per -, max 6) [6]

2 **(a)** -One to one
-Mnemonics are used to represent operation codes
-Labels are used to represent memory addresses
-machine code is binary codes (only)
-assembly code can not be executed // machine code can be executed
-machine code and assembly language are both low level languages (machine specific)
(1 per -, max 2) [2]

(b) -Labels added to a symbol table
-Labels are later looked up to determine the actual address / Assembler must allocate addresses to labels
-Mnemonic looked up in opcode table to find operation code
-Macro instructions used to stand for groups of instructions
(1 per -, max 2) [2]

(c) **(i)** -Address in instruction is the address of the address of / pointer to the location...
-which contains the data to be used [2]

(ii) -Address in the instruction has added to it
-the contents of the Index Register/IR [2]

(iii) -Address in the Instruction is the displacement
-from the address of the first/current instruction
-the value is added to the PC [2]

3 -Coaxial cable
-description/one transmission medium (copper) surrounded by insulation

-Twisted pair
-description/two conducting wires twisted around each other

-Optic fibre
-many fibres contained
-description/fine glass strands carry light signals // optic fibre is very fragile
-Interference free

-Wireless communication
-Radio signals
-open to interception / latency / uses WEP keys for security

-Infrared/Microwave
-restricted by line of sight
-transfer rate statement
-range statement

(1 per -, max 8) [8]

4 **(a)** -A system in which the output is produced quickly enough to affect the next input /current process
-a system that reacts fast enough to influence behaviour in the outside world [1]

(b) -A number of sensors stationed around apartment
-Temperature/humidity sensor sends temperature/humidity to processor
-Use analogue to digital converter to convert the temperature/humidity measurements
-Processor decides whether air conditioning system is in operation
-(processor) compares measured temperature/humidity to required temperature/humidity
-If necessary actuator is used to adjust settings/turn on cooling/heating/humidifier
-Delay before next reading is taken from temperature/humidity sensor. // temperature readings are sampled // taking readings is repeated

-Sensors on windows to warn if they are open during operation.
(1 per -, max 4) [4]

(c) Any suitable real-time or pseudo-real-time application e.g.
-To play a racing game
-So that the player can steer the car realistically
-any reservation type system
-to prevent double booking [2]

5 **(a)** -Temporarily storing data for output later
-several computers can send data to be printed at the same time
-when queuing jobs sent to a single device
(1 per -, max 2) [2]

(b) **(i)** -Jobs can be queued to ensure that none are missed
-Stops jobs being frozen/lost when printer unavailable
-complete documents are printed

(ii) -print jobs are stored on secondary storage
-jobs can be given a print priority
-jobs are maintained by a queue / priority queue data structure
-data structure consists of reference data to each print job
-When printer free, job with highest priority / at head of queue is printed
-print files are sent from secondary storage to print buffer.
(1 per -, max 4 per dotty, max 5) [5]

6 **(i)** -language to describe/alter table designs (NOT file)
-includes Identifiers/data type/relationships
-any validation rules that the data must adhere to…
(1 per -, max 2) [2]

(ii) -designed to allow a user to query/retrieve data/sort the database
-insert / delete / update
-data in the database / table(s)
(1 per -, max 3) [3]

7 **(i)** –106 [1]

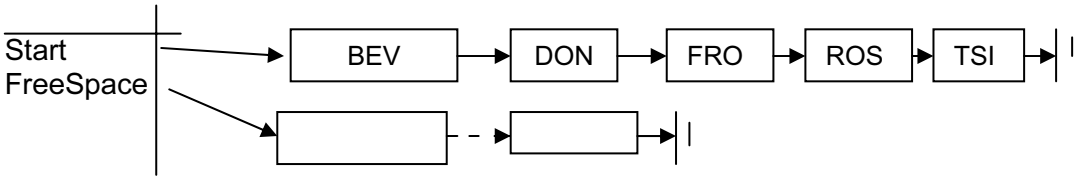
(ii) –22 [1]

(iii) 96 (1 per digit) [2]

8 (a) (i) -A dynamic data structure changes size // A static data structure has the same size
-dynamic data structure matches size to data requirements // static data structure takes no account of data requirements
-dynamic data structure takes memory from heap as required
-static data structure is predefined at compile time [2]

(ii) *Advantage:*
-Array is of fixed size which simplifies algorithms // or by example e.g. retrieval of data
-Array controls the maximum size of the queue
Disadvantage:
-Queue held in an array cannot expand beyond the size of the array
-If queue is small then memory space is wasted. [2]

(b) (i) Either:



Start: 5 NFree: 6

1	FRO	4
2	TSI	X
3	DON	1
4	ROS	2
5	BEV	3
6		

Start: 4 NFree: 5

0	FRO	3
1	TSI	X
2	DON	0
3	ROS	1
4	BEV	2
5		

Mark as follows ...
-Start pointer + some value/arrows
-All values included
-Null pointer
-Indication of free space

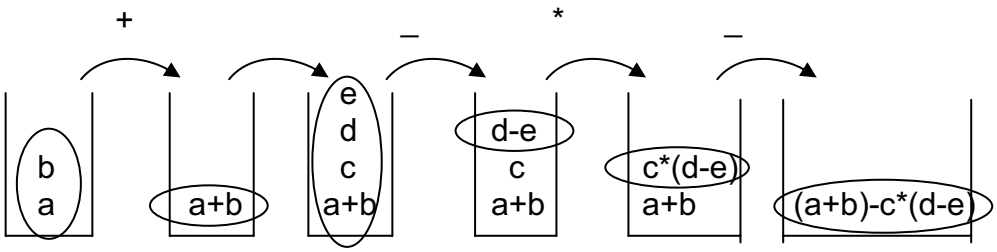
Diagram in arrival order
-in arrival order
-with correct pointers
OR
Diagram in alphabetical order
-with correct pointers
OR
Array diagram
-in arrival order
-correct pointers
(1 per -, max 5) [5]

(ii) -Input NewItem
-Store NewItem in next free space
-Set Current to value at Start
-Read values in list following pointers.
-until Current value in list > NewItem
-Pointer of Previous points to NewItem
-NewItem points to Current
-update free space list
-Mention of any special cases e.g. NewItem being First in list // list empty // list full // no free space

(1 per -, max 5) [5]

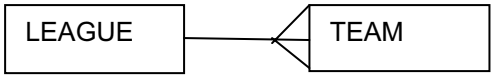
9 **(a)** -reverse Polish expressions can be processed directly from left to right
-Is free of ambiguities
-does not require brackets
-does not require use of rules of precedence
(1 per -, max 2) [2]

(b)



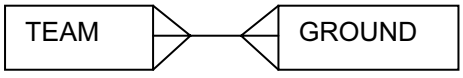
Mark points:
-at least two operators shown between transitions
-a and b in first stage
-a+b after first operator
-e,d,c, (a+b) in stack in correct order
-(d-e)
-c*(d-e)
-(a+b)-c*(d-e)
(1 per -, max 6) [6]

10 **(i)** One to many



[2]

(ii) Many to many



[2]

(iii) -Link table needed...
-with primary key made up of combination of primary keys of TEAM and GROUND
-Primary keys of TEAM and GROUND used as foreign keys in link table
-This turns the many to many relationship into..// a many-to-many relationship can not be implemented
-One-to-many and many-to-one/ 2x one-to-many relationships
(1 per -, max 4) [4]

11 **(a)** -Interpreter translates one instruction, runs it before going on to the next // Compiler translates all the instructions before run.
-Compiler creates object code/executable file // Interpreter does not
-Interpreter makes for easier debugging
-Compiled programs will execute faster // interpreted code will execute slower
-Interpreter must be present to run the program // compiler not needed at runtime
-Interpreter will translate code in loops more than once // Compiler only once
-once compiled no further translation needed // every program execution requires interpreter
(1 per -, max 3) [3]

(b) **(i)** -Contents copied from PC
-Contents changed to the operand/address part of CIR [2]

(ii) -Instruction copied from memory/location to MDR when contents of MAR are from PC
-Data copied from memory/location to MDR when instruction is LOAD
-Data copied from ALU/Accumulator to MDR when instruction is STORE [max 2]

12 -Must safeguard against unauthorised access to the computer system
-Firewall used to restrict access to known sources
-Control access to the network using accounts/user IDs with passwords // procedures in place for authentication
-File contents can be encrypted
-procedures in place to protect against malware

-all payments/communication can be made through a secure connection
-need to safeguard against bogus websites

-Procedures in place for authorisation of resources
-Users allocated access rights to various resources // users have access to certain files/folders only
-Files can be password protected / read-only
-users can access the network from certain terminals only / certain times of the day only
-use of digital signatures
(1 per -, max 6) [6]