

CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the October/November 2013 series

9691 COMPUTING

9691/31

Paper 3 (Written Paper), maximum raw mark 90

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1 (a) (i) $a \ b + 7 \ /$ [1]

(ii) $2 \ 3 \ z \ * \ 5 \ + \ /$
1 [1]

2nd mark for completely correct [1]

(b) evidence for 12 and 4 [1]
3 [1]

(c) (i) In-order traversal // (Traverse each subtree in the order) left-root-right [1]

(ii) $E \ M \ c \ 2 \ ^ \ * \ =$ [1]

(iii) Post-order traversal // (Traverse each subtree in the order) left-right-root [1]

[Total: 8]

2 (a) Security is improved/better managed [1]

Different users can have different 'views' of/access to data [1]

Program-data independence // Changing a field does not require an applications program re-write [1]

Queries and reports quickly produced [1]

Reduced data duplication/redundancy [1]

Reduced data inconsistencies [1]

Better managed data integrity/data validation // Validation code does not need to be present in all applications programs [1]

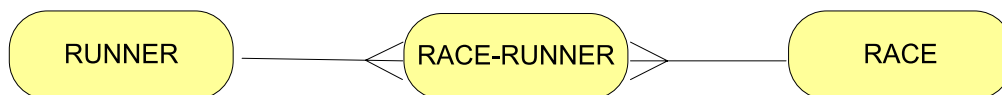
If implemented with a DBMS it will allow concurrent access to the database [1]

MAX 3

(b) (i) many runners compete in many races // many-to-many // M:m [1]

(ii) one club organises many races // one-to-many // 1:M [1]

(c) (i)



Intermediate table (not labelled RUNNER, RACE, CLUB, etc.) [1]

2 X one-to-many relationship [1]

(ii) Primary key of RACE/Primary key RaceDate [1]

// Primary key of RUNNER/Primary key MemberID [1]

Is used as a foreign key in the link table [1]

(d) (i) (Yes) since there is a not a repeated group of attributes [1]

(ii) (Yes) Since there is only a single attribute primary key
// there are no partial dependencies
// all non-key attr. are dependent on the primary key [1]

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(iii) There are dependent non-key attributes // ClubAddress is dependant on ClubName [1]

(iv) RUNNER(MemberID, RunnerName, RunnerDOB, ClubName) [1]

CLUB(ClubName, ClubAddress) [1]

If primary key not indicated penalise once only

(e) Avoids data duplication/repeated data [1]

Avoids data inconsistencies [1]

Ensures data integrity [1]

(f) SELECT RaceDate, OrganisingClubName [1]

FROM RACE [1]

WHERE RaceDate > #01/01/2013# AND Distance < 10 [1]

Do not penalise imprecise syntax in the WHERE line

[Total: 19]

3 (a) a single processor
program consists of a sequence of stored instructions [1]
Instructions + data [1]
are stored (in a continuous block) of primary/main memory [1]
instructions are executed in sequence [1]
MAX 2

(b) (i) 122 [1]

(ii) 5C [1]

(iii) Fewer digits used to represent any number // long string difficult to interpret [1]

Less likely to make a mistake when copying/converting a digit string [1]

Easy to convert from binary to hex (vice versa) than binary to denary [1]

MAX 1

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(c) (i) 16 bits

[1]

(ii)

Fetch stages	Special purpose registers				Busses	
	PC	MAR	MDR	CIR	Address bus	Data bus
	7A					
MAR \leftarrow [PC]		7A			✓	
PC \leftarrow [PC] + 1	7B					
MDR \leftarrow [MAR]			2150			✓
CIR \leftarrow [MDR]				2150		

For the buses column penalise once for any additional incorrect ticks

MAX 5

(d)

Instruction	Register	
	Accumulator (ACC)	Index Register (IX)
LIX 200		3
LDD 201	216	
LDI 201	96	
LDX 201	63	

1 per contents

[4]

[Total: 15]

- 4 A class is the design/blueprint/template (from which objects are later created) [1]
A class consists of properties/attributes and methods/procedures/functions [1]

An object is an instance of a class [1]

An object must be based on a class definition [1]

Many objects can exist for the same class [1]

MAX 3

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(b) The class diagram includes:

BOOK + RECORDING subclasses [1]

FILM + MUSIC subclasses of RECORDING [1]

Recognised notation for inheritance [1]

RESOURCE class Title : STRING
OnLoan : BOOLEAN [1]

BOOK class Author : STRING [1]

FILM class RunningTime : INTEGER [1]

MUSIC class NoOfTracks : INTEGER [1]

RECORDING class ReleaseDate : DATE [1]

MAX 8

(c) *Encapsulation*

Combining together of an object's properties and the methods [1]

Restricts the programmer's access to the object's data // Hiding of data [1]

Data values can only be read/written using the methods of the class [1]

[Total: 13]

5 (a) Last item added is the first item to leave // or equivalent wording [1]
R. LIFO

(b) (i) HARRIS [1]
17843 [1]

(ii) PROCEDURE PushJob
IF TopOfStack = 1000 [1]
THEN
OUTPUT "Stack is already FULL"
ELSE
INPUT NewUserID
INPUT NewReferenceNo [1]
TopOfStack ← TopOfStack + 1 [1]
SpoolJob[TopOfStack].JobReference ← NewReferenceNo
SpoolJob[TopOfStack].UserID ← NewUserID [1]
ENDIF
ENDPROCEDURE

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(c) PROCEDURE PopJob
 IF TopOfStack = -1 [1]
 THEN
 OUTPUT "There are no print jobs waiting" [1]
 ELSE
 PROCESS SpoolJob[TopOfStack]
 TopOfStack ← TopOfStack - 1 [1]
 ENDIF
 ENDPROCEDURE

(d) May not be a fair way to order the outputs [1]
 Some print jobs may wait a long time before printing [1]
 Better choice is a queue [1]
 Since first print job sent will be the first to be output // First in – First out [1]
 MAX 3

[Total: 13]

6 (a) (i) File allocation table
 Storage space is organised into allocation units/clusters [1]
 There is a record for each allocation unit/cluster [1]
 Records are marked as either used // available // unusable [1]
 Allocation units/clusters for each file are maintained as a linked list [1]
 There is a separate FAT for each logical volume/partition [1]
 MAX 2

(ii) Allocation units allocated to the file ... [1]
 Have their record status changed to 'available' [1]

(b) (i) 1. Save the contents of the program counter on the stack [1]
 2. Also save contents of all other registers [1]
 3. Load and run the appropriate Interrupt Service routine (ISR) [1]
 4. Restore all other registers
 5. Restore the Program Counter [1]
 6. Continue execution of the interrupted process

(ii) Disable interrupts of a lower priority (before step 1) [1]
 Check for receipt of interrupt (during Step 3) [1]
 If interrupt received before completion of step 3, go to step 1
 // Save the registers for the current process – the ISR [1]
 Compare priority with level below which interrupts already disabled [1]
 Enable interrupts of a lower priority (after Step 5) [1]
 MAX 3

[Total: 12]

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- 7 (a) Possible answers include:
- Encryption of email traffic [1]
Email data if intercepted cannot be read [1]
- Encryption of passwords [1]
Designed to prevent unauthorised access [1]
- (b) *Encryption algorithm ...*
The calculation/process/sequence of steps for converting the message text/data [1]
- Encryption key*
A number/parameter used by the encryption algorithm // e.g. the displacement shift for transposing characters [1]
- (c) *Asymmetric encryption ...*
Private key is known only to the owner//Public key is known by both parties [1]
Public and private keys are obtained from the purchase of a digital certificate //
Keys are generated at the start of a secure (e.g. web or email) session [1]
- EITHER ...*
Sender will use their own private key [1]
Receiver decrypts using the sender's public key [1]
- OR*
Sender uses the recipient's public key [1]
Receiver decrypts using their own private key [1]
MAX 3
- (d) *Authorisation ...*
Different permissions granted to different users [1]
Restricted access to certain data files/directories/physical devices [1]
User IDs MAX 1
- Authentication*
Passwords [1]
(Digital) signature // (Digital) certificate [1]
Use of biometric data and methods [1]
MAX 1
- [Total: 11]**