

**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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Page 2	Mark Scheme	Syllabus	Paper
	GCE A LEVEL – October/November 2013	9691	31

- 1 (a) (i)  $a b + 7 /$  [1]
- (ii)  $2 \frac{3 z * 5 +}{1} /$  [1]  
 2<sup>nd</sup> 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)
- ```

    graph LR
      RUNNER((RUNNER)) ==> RACE_RUNNER((RACE-RUNNER))
      RACE_RUNNER ==> RACE((RACE))
  
```
- 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 [1]  
 // there are no partial dependencies [1]  
 // all non-key attr. are dependent on the primary key [1]

| Page 3 | Mark Scheme                         | Syllabus | Paper |
|--------|-------------------------------------|----------|-------|
|        | GCE A LEVEL – October/November 2013 | 9691     | 31    |

(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 [1]  
 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

(c) (i) 16 bits

[1]

(ii)

| Fetch stages  | Special purpose registers |     |      |      | Busses      |          |
|---------------|---------------------------|-----|------|------|-------------|----------|
|               | PC                        | MAR | MDR  | CIR  | Address bus | Data bus |
|               | 7A                        |     |      |      |             |          |
| MAR ← [PC]    |                           | 7A  |      |      | √           |          |
| PC ← [PC] + 1 | 7B                        |     |      |      |             |          |
| MDR ← [MAR]   |                           |     | 2150 |      |             | √        |
| CIR ← [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

| Page 5 | Mark Scheme                         | Syllabus | Paper |
|--------|-------------------------------------|----------|-------|
|        | GCE A LEVEL – October/November 2013 | 9691     | 31    |

(b) The class diagram includes:

|                                                        |     |
|--------------------------------------------------------|-----|
| BOOK + RECORDING subclasses                            | [1] |
| FILM + MUSIC subclasses of RECORDING                   | [1] |
| Recognised notation for inheritance                    | [1] |
| RESOURCE class      Title : STRING<br>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<br>R. LIFO                                                                                                                                                                                                                                             | [1]                      |
| (b) (i) HARRIS<br>17843                                                                                                                                                                                                                                                                                                          | [1]<br>[1]               |
| (ii) PROCEDURE PushJob<br>IF <b>TopOfStack = 1000</b><br>THEN<br>OUTPUT "Stack is already FULL"<br>ELSE<br>INPUT NewUserID<br><b>INPUT NewReferenceNo</b><br><b>TopOfStack ← TopOfStack + 1</b><br>SpoolJob[TopOfStack].JobReference ← NewReferenceNo<br><b>SpoolJob[TopOfStack].UserID ← NewUserID</b><br>ENDIF<br>ENDPROCEDURE | [1]<br>[1]<br>[1]<br>[1] |

| Page 6 | Mark Scheme                         | Syllabus | Paper |
|--------|-------------------------------------|----------|-------|
|        | GCE A LEVEL – October/November 2013 | 9691     | 31    |

```

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

| Page 7 | Mark Scheme                         | Syllabus | Paper |
|--------|-------------------------------------|----------|-------|
|        | GCE A LEVEL – October/November 2013 | 9691     | 31    |

- 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]**