

**MARK SCHEME for the May/June 2012 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.

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- 1 (a) (i) The table/each student has a repeated group of attributes // each student has a number of subjects [1]
- (ii) StudentName, TutorGroup and Tutor would need to be repeated for each record [1]

(b)

Table: Student

| StudentName | TutorGroup | Tutor |
|-------------|------------|-------|
| Tom         | 6          | SAN   |
| Joe         | 7          | MEB   |
| Samir       | 6          | SAN   |

Table: StudentSubjectChoices

| Student Name | Subject      | Level | Subject Teacher |
|--------------|--------------|-------|-----------------|
| Tom          | Physics      | A     | SAN             |
| Tom          | Chemistry    | A     | MEB             |
| Tom          | Gen Studies  | AS    | DIL             |
| Joe          | Geography    | AS    | ROG             |
| Joe          | French       | AS    | HEN             |
| Samir        | Computing    | A     | VAR             |
| Samir        | Chemistry    | A     | MEB             |
| Samir        | Maths        | A     | COR             |
| Samir        | Gen. Studies | A     | DIL             |

Mark as follows ....

- Complete Student table [1]
- Repetition of StudentName in StudentSubjectChoices table [1]
- Complete columns 2, 3, and 4 [1]

- (c) (i) *primary key...*  
 - an attribute/combination of attributes  
 - chosen to ensure that the records in a table are unique // used to identify a record/tuple [2]
- (ii) StudentName + Subject Correct Answer Only [1]
- (iii) - there is a one-to-many relationship // Student is the 'one side' table – StudentSubjectChoices is the 'many side' table.  
 - The primary key (attribute StudentName) in Student  
 - Links to StudentName in the StudentSubjectChoices table  
 - (StudentName in the) StudentSubjectChoices table is the foreign key // StudentName is the foreign key that links the two tables [MAX 2]

- (d) - There are non-key attributes ...  
 - SubjectTeacher ...  
 - dependent only on part of the primary key (i.e. Subject) // partial dependency [MAX 2]

- (e) - There are dependent non-key attributes // there are non-key dependencies  
 - TutorGroup is dependant on Tutor // Tutor is dependent on TutorGroup [2]

**[Total: 14]**

- 2 (a) 83 [1]

- (b) 153 [1]

|               |                                       |                 |              |
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(c) –110 [1]

(d) (i) +13

*mark as follows:*

Exponent: +4 // move the pattern four places

Mantissa: +13/16 // 0.1101

Answer:  $13/16 \times 2^4$  // or equivalent [3]

(ii) There will be a unique representation for a number

The format will ensure the number is represented with the greatest possible/more accuracy/precision

Multiplication is performed more accurately/precisely [MAX 1]

(iii) Mantissa: 0100 0000

Exponent: 1000

Therefore number is  $\frac{1}{2} \times 2^{-8}$  // +1/512 //  $+2^{-9}$  // 0.00195 [3]

(e) choices made will effect range and accuracy

More bits used for the mantissa will result in better accuracy

More bits use for the exponent will result in larger range of numbers [Max 2]

**[Total: 12]**

3 (a) Boolean [1]

Flags whether or not the requested customer name is found [1]

SearchName [1]

Index [1]

Index + 1 [1]

Index = 2001 // Index >= 2001 // Index > 2000 [1]

IsFound = FALSE // NOT IsFound // Index = 2001 // Index > 2000 [1]

(b) - values are considered in sequence

- when an item is not found all items are considered

- Few comparisons are needed if the value is near the start of the list // Many comparisons are needed/it's time consuming if the value is near the end of the list

- The average number of comparisons needed will be  $N/2$  (or 1000 for this data set) [MAX 2]

(c) (i) The values must be in order

Calculate the middle value and compare with the requested value

If Requested value is less/greater discard the top/bottom list

Repeat with a new list // compare with a new middle value

Continue until value is found or list is empty [MAX 4]

(ii) *Compare with ...*

Kiwi

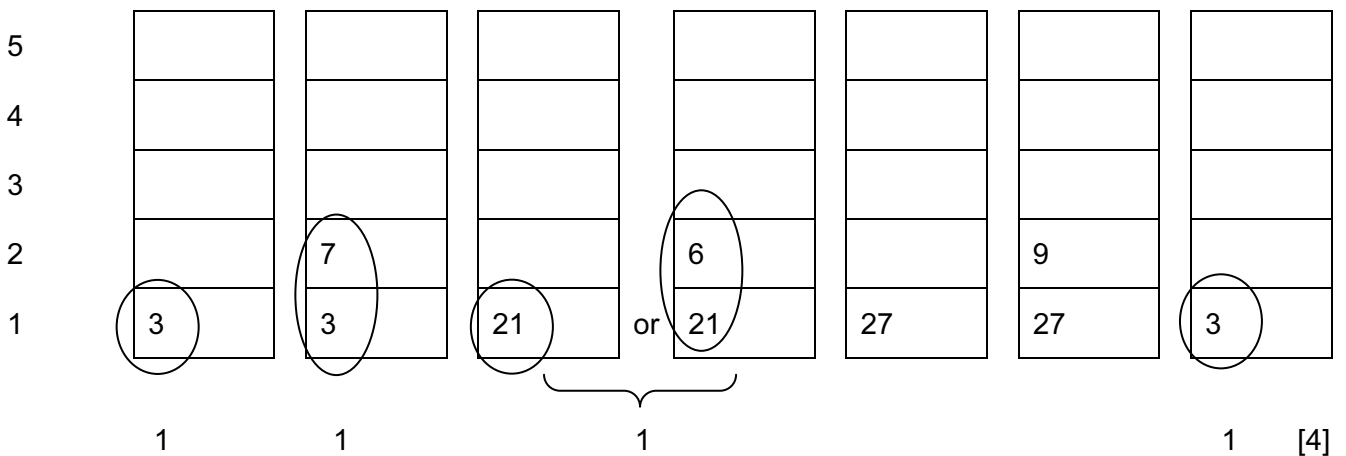
Banana

Cherry [3]

**[Total: 16]**

- 4 (a) 21 [1]
- (b) (i)  $a^5 - bc + /$  [1]
- (ii)  $2^3 * 6^2 / +$  [2]
- (c) Expressions can be evaluated without the use of brackets  
Operators are in execution order / No need to apply a precedence of operators [1]
- (d) (i) Last item added to the stack will be the first item to leave [1]
- (ii) **Static** structure  
The size of the array will be fixed / size will be defined before the array is used [2]

(iii)



[Total: 12]

5 (a)

LDD 105

Accumulator

0001 0001

Main memory

|     |           |
|-----|-----------|
| 100 | 0100 0000 |
| 101 | 0110 1011 |
| 102 | 1111 1110 |
| 103 | 1111 1010 |
| 104 | 0101 1101 |
| 105 | 0001 0001 |
| 106 | 1010 1000 |
| 107 | 1100 0001 |
|     |           |
|     |           |
| 200 | 1001 1111 |

Mark as follows:

- Sensible annotation which makes clear 105 is the address used
- Final value in Acc

[2]

(b)

LDX 101

Accumulator

0101 1101

Index Register

00000011

| Main memory |           |
|-------------|-----------|
| 100         | 0100 0000 |
| 101         | 0110 1011 |
| 102         | 1111 1110 |
| 103         | 1111 1010 |
| 104         | 0101 1101 |
| 105         | 0001 0001 |
| 106         | 1010 1000 |
| 107         | 1100 0001 |
|             |           |
| 200         | 1001 1111 |

Mark as follows:

- IR contents converted to 3
- Computed address of 101 + 3 = 104
- // explanation: add contents of IR to address part of instruction
- Then, 'direct addressing' to 104
- Final value in Acc

[MAX 4]

(c)

| Accumulator | Memory Address |     |     |     |
|-------------|----------------|-----|-----|-----|
|             | 507            | 508 | 509 | 510 |
| 22          | 22             | 170 | 0   | 0   |
| 23          |                |     |     |     |
|             |                |     | 23  |     |
| 170         |                |     |     |     |
| 171         |                |     |     |     |
|             |                |     |     | 171 |

Mark as follows ...

- 22 to Accumulator
- Incremented to 23
- 23 copied to address 509
- 170 copied to Accumulator and incremented to 171
- 171 in address 510

[5]

(d) Every assembly language instruction is translated into exactly one machine code instruction / there is a 1-to-1 relationship between them [1]

[Total: 11]

|               |                                       |                 |              |
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- 6 (a) Decide which process ...  
 Gets next use of the processor (low level scheduler)  
 // is next loaded into memory (high level scheduler)  
 maximise system resources [2]
- (b) (i) Running  
 The process currently has the use of the processor
- Runnable/Ready  
 The process would like to use the processor but the processor is currently in use by another process
- Suspended/Blocked  
 The process is not capable of using the processor / the process is currently occupied doing I/O [6]
- (ii) Maintain a separate 'data structure' for the processes in each state  
 one field of the Process Control Block will store the current state [1]
- (c) (i) *Processor bound ...*  
 The process does very little I/O // the process requires the processor most of the time  
 3D-graphics calculation // any plausible application
- I/O bound ...*  
 The process does lots of I/O // the process requires little processor time // any plausible application [4]
- (ii) Priority to I/O bound processes  
 Otherwise they will not get a look in // processor bound jobs would monopolise the processor [2]
- [Total: 15]**
- 7 (a) a model/program of the real-world system is produced  
 to predict the likely behaviour of a real-world system [2]
- (b) *Computer system suitable as ...*  
 A computer program/system can be written/created which model the problem/application  
 The problem can control the values of all the variables/parameters  
 The computer can produce results very quickly // e.g. models what actually takes several days into 5 minutes processing  
 The simulation removes any element of hazard/danger  
 Some real-world problems are impossible to create  
 It will be cost-effective to model the problem first [MAX 2]

|               |                                       |                 |              |
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- (c) Time taken to serve a customer  
Number of items in the customer basket  
Acceptable wait time in the queue  
Number of checkouts  
Time of day/day of the week  
Number of customers arriving  
Speed of the checkout operators  
Anything plausible ... [MAX 3]

- (d) - Increase the average time taken to serve a customer  
- ... will increase the average queue length  
Or anything plausible ... [2]

**[Total: 9]**