

# Markscheme

November 2017

Computer science

Standard level

Paper 1

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## Section A

1. *Award up to [2 max].*  
Fixed vocabulary;  
Unambiguous meaning;  
Consistent grammar;  
Consistent syntax;  
Provide a way to define basic data types and operations on those types (ability to write functions/procedures);  
Provide ability of Input and output handling;  
Provide some kind of loop that can be stopped / conditional statement / branching (conditional and unconditional branching);  
It should have variables that reference computer memory, syntax for basic arithmetic and logical;  
Operations on those memory locations;  
It has to run on/be able to be processed by a computer (*ie* it must have a compiler/interpreter)

**Note:** do not accept aspects that address interoperability/portability/standards/user friendliness

[2]

2. Compare (*accept* Check);  
Store (*accept* Write / Save);

**Note:** Accept the following wording for categories of operations

Input (Read);  
Processing/execution (*eg* calculate, decode, fetch, delete, evaluate, sort, transfer, transmit);  
Output;  
Control;

**Remark:** Beware of repetitions with the wording in the question paper, or repetitions between the two given examples. Marks should not be awarded twice in those cases.

*For example,*

*Search/look up, or comparable wording, are synonyms of the given Retrieve;*

*Insert/put, or comparable wording, are synonyms of the given Add;*

*Lists of repeated arithmetic operations that fall under examples of calculations (subtract, divide, multiply, square) are all examples of calculations, and hence processing.*

[2]

3. (a) A piece of computer hardware or software that accesses a service made available by a server /  
The role of a client is to access a service made available by a server by sending a request for service;

**Note:** *the term client is to be understood only from the computing perspective, ie this is not a human.*

[1]

- (b) A program/host computer that awaits and fulfills requests from client programs (in the same or other computers) /  
The role of a server is to fulfill requests from client programs (which can reside in the same or in other computers)

**Note:** *the term server is to be understood only from the computing perspective, ie this is not a human.*

[1]

- 4. Award up to [1 max].  
Text-to-speech;  
Voice recognition;  
Braille keyboards;  
Touch screen;  
Input from scanner;

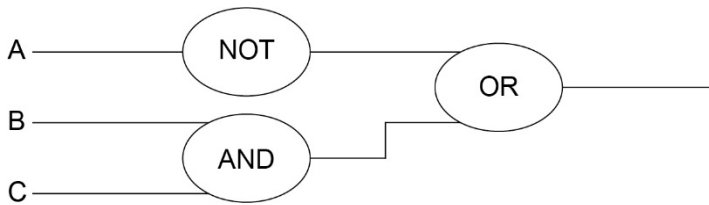
[1]

- 5. Award [1] for all correct input values, [1] for a correct A NOR B column and [1] for a correct (A NOR B) OR A column.

A	B	A NOR B	(A NOR B) OR A
FALSE	FALSE	TRUE	TRUE
FALSE	TRUE	FALSE	FALSE
TRUE	FALSE	FALSE	TRUE
TRUE	TRUE	FALSE	TRUE

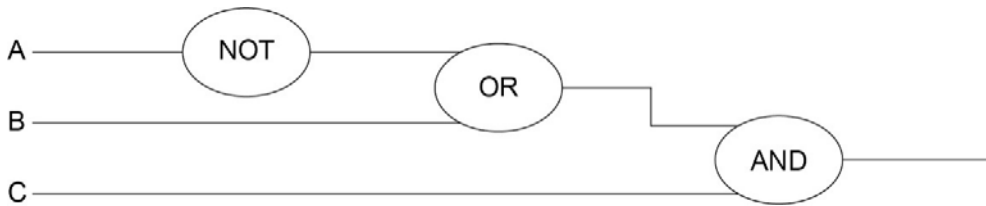
[3]

- 6. Award [1] for each correctly placed gate, up to [3 max].



[3]

**Note:** Award only [1] for an answer of:



- 7. (a)  $N^2$  [1]
- (b)  $N$ ; [1]
- (c) *Award marks as follows up to [4 max].  
Award [1] for correct initialization.  
Award [1] for correct condition.  
Award [1] for correct output.  
Award [1] for changing the value of controlling variable.*

**Note:** The question explicitly requires one *while* loop.  
Do not accept a *for* loop. Do not accept two *while* loops.

**Example answer**

```
K = 1
loop while K <= N
  output K
  K = K + 1
end loop
```

**Example answer (including J variable)**

```
K = 1
J = 1
loop while K = J AND K <= N
  output K
  K = K + 1
  J = J + 1
end loop
```

[4]

- 8. (a) Primary memory / RAM [1]
- (b) *Award up to [2 max].  
**Note:** there must be explicit reference to both address and data bus*

**Example 1**

Buses are used as physical connections to carry information to the CPU;  
The data bus transports data from/to CPU, whereas the address bus the memory address where the data is supposed to go/be.

**Example 2**

Data bus is a physical connection to transport data from-to CPU to be processed;  
Address bus is a physical connection to transport an address of memory storage where data (transported in the data bus) should be read/written;

**Note:** Award [1] mark, for responses that show some understanding of use of buses in CPU, for address location and data transport without using specialist terminology

[2]

9. Binary digit;  
(Minimal) unit of storage that can be set to 0 or 1; [1]
10. *Award up to [2 max].*  
Involves sending sample software to the intended audience;  
(Selected audience do not pay for this software);  
To try/use the software product;  
And give the feedback to the authors (which help in correcting bugs); [2]

### Section B

11. (a) Each word in the text file is compared with words in a dictionary (held in memory/online);  
If the word is found in the dictionary it is correctly spelt / if the word is not found in the dictionary, spellchecker will recognize that it is incorrectly spelt; [2]
- (b) *Award [1 max].*  
If power goes off, only the text typed after last (automatic) save is lost;  
**NOTE:** *accept responses that express evidence of just a partial loss of the file.* [1]
- (c) *Award up to [2 max].*  
Apply styles, effects;  
Insert (tables/pictures/graphs/formulas/...);  
Mail merge;  
Macros;  
Print;  
etc. [2]
- (d) *Award [1] for stating an application software package and [1] for stating its use in the office, up to [2 max].*  
  
Example answers  
Spreadsheet;  
For graphically presenting various data;  
  
Database software;  
For holding employees/customers data;  
  
Web page creators/editors;  
To create/manage the office's web pages;  
etc. [2]
- (e) *Award up to [2 max].*  
  
Off site data storage;  
Make backups regularly/periodically/frequently;  
  
Prevent physical damage to the computers / Keep equipment in safe and dust-free places / Protect equipment from static electricity that can erase data or damage components / Protection during lightning and electrical storms;  
  
**Note:** *Accept any reasonable examples, but there should be more than one. The focus of the question is on data loss, and not in relation to security/hacking.* [2]
- (f) *Award [1] for stating a problem and [1] for an elaboration, up to [2 max].*  
Users/employees might be afraid of these changes (for various reasons);  
And not willing to help in this change;  
  
Data migration problems;  
For example, different file formats so conversion must be performed;  
  
Employee efficiency may drop;  
As they learn to use the new system;  
  
Issue of compatibility with legacy software/hardware;  
So features of new software/hardware may not work correctly; [2]

- (g) Award **[1]** for outlining what is meant by direct changeover, **[1]** for outlining what is meant by phased conversion, and then **[1]** for an advantage or disadvantage of each, up to **[2]**.

**Example answer:**

Direct changeover, the old software and hardware is completely replaced, in one move, by the new software and hardware;

Phased conversion involves selecting one section in the office for the direct changeover and other sections will be switched when the first section selected is running satisfactorily. Eventually the whole office has been changed;

A phased conversion is less risky than a direct changeover as any problems that might arise will be isolated in only one section in the office;

Direct changeover means everyone in the organization has same software/hardware and so there are no compatibility issues;

**[4]**

12. (a) Award up to **[1 max]**.

Wireless router/modem;

Access points;

Switch;

Wireless repeater/extender/booster;

**[1]**

- (b) Award **[1]** for identifying a disadvantage and **[1]** for an expansion, for **two** disadvantages up to **[4 max]**.

Data transfer will decrease (compared with a wired LAN);

Because the number of computers using the network increases;

(and because) WLAN has lower bandwidth than a wired LAN;

Less data security;

As devices from outside the school can access the network/intercept transmissions;

More easily open to misuse;

As teacher/administrator cannot directly monitor a specific student/teacher/machine;

Intermittent connectivity due to physical barriers (walls);

Results in low transfer/speed and may hinder operations.

**Note:** Accept any reasonable points, provided they are appropriately elaborated.

**[4]**

- (c) Award up to **[3 max]**.

Give each user appropriate login details/passwords;

Different access rights for students, teachers, school administrators (file-level and share-level security);

All passwords and files should be encrypted;

Use the latest WiFi protocol/WPA2;

Require MAC address authentication;

Password protect the documents;

**Note:** the focus of the question is on confidential data (firewalls not accepted)

**[3]**



- (d) Set of rules for data transmission; [1]
- (e) Award up to [6] as follows:

*Award up to [3 max] for a general description of how data is transferred by packet switching. ([1 max] if this general description is very simplistic and refers to just the Header/Data/Trailer already shown in the question paper).*

*Award up to [3 max] for added detail that references the contents of the given data packet in the answer.*

**Example of general description**

Data is organized in specially formatted units (data packets) which are routed from source to destination using network switches and routers;

Network switches and routers determine how best to transfer the packet between a number of intermediate devices (routers and switches) on the path to its destination (rather than flowing directly over a single wire on the path to its destination);

Data packets are reassembled at the destination;

**Example of referencing content**

**Addresses** have to be in a standard format so that each switch/routing station recognizes the address;

**Address of sender** identifies the sending computer, so that any packets not received can be re-requested;

**Address of receiver** identifies intended recipient so it can be forwarded on correctly;

The **protocol** used must be identified so that the correct rules are followed;

**Size of packet / size of fields in packet** – All packets/fields must have the same size so that the data can be reassembled;

**Sequence number** so that packets can be reassembled in correct order;

**Transmission codes** to show whether the data packet is transmitted or re-transmitted;

**Control bits**, to maintain the integrity of the data by ensuring that the data received is the same as the data sent;

**Error checking code** – when an error is detected, an algorithm either corrects the error or requests that the packet is resent;

[6]

13. (a) 3; [1]  
 (b) Award [1] for each correct column, other than column K.

K	CL	K < len(S)	S[K] = "E"	output
0	0	TRUE	FALSE	
1	"	"	"	
2	1	"	TRUE	
3	"	"	FALSE	
4	"	"	"	
5	"	"	"	
6	"	"	"	
7	"	"	"	
8	"	"	"	
9	2	"	TRUE	
10	"	FALSE		2

[4]

**Note:** The symbol " appearing in cells above means that the value in that cell is the same as the one in the cell just above it; unfilled cells means that no value must be present.

**Remark:** Accept drawings of tables where the values of the column CL are shifted downwards of one cell only, therefore showing the first value 2 when K = 10. Do not propagate by FT to the other columns, they are independent from the way CL has been filled.)

[4]

- (c) **Example answer 1**  
 Award marks as follows up to [5 max].  
 Award [1] for correct boundaries in first for-loop.  
 Award [1] for correct assignment of array *SUBSTITUTE* in first loop.  
 Award [1] for correct boundaries in second for-loop.  
 Award [1] for correct assignment of array *SUBSTITUTE* in second loop.  
 Award [1] for incrementing *IND* in both loops.

```

IND = 0
loop for K from N to len(UPCASELETTERS)-1
    // accept 'K from 0 to 25'
    SUBSTITUTE[IND] = UPCASELETTERS[K]
    IND = IND+1
end loop
loop for K from 0 to N-1
    SUBSTITUTE[IND] = UPCASELETTERS[K]
    IND = IND+1
end loop
    
```

**Example answers 2 and 3**

Award marks as follows up to **[5 max]**.

Award **[1]** for initializing array *SUBSTITUTE*.

Award **[1]** for repeating the process *N* times.

Award **[1]** for temporarily storing *SUBSTITUTE[0]*

Award **[1]** for correctly shifting to the left the contents of array *SUBSTITUTE*.

Award **[1]** for correctly placing the temporary stored value in the last position in *SUBSTITUTE*, after shifting

**Example answer 2**

```
loop for K from 0 to 25
    SUBSTITUTE[K] = UPCASELETTERS[K]
end loop
    // accept SUBSTITUTE = UPCASELETTERS
loop for K from 1 to N
    TEMP = SUBSTITUTE[0]
    IND = 0
    loop while IND <= 25
        SUBSTITUTE[IND] = SUBSTITUTE[IND + 1]
        IND = IND + 1
    end loop
    SUBSTITUTE[25] = TEMP
end loop
```

**Example answer 3 (with for loops)**

```
loop for K from 0 to len(UPCASELETTERS)-1
    // accept "K from 0 to 25"
    SUBSTITUTE[K] = UPCASELETTERS[K]
end loop
    // accept SUBSTITUTE = UPCASELETTERS
loop for K from 1 to N
    TEMP = SUBSTITUTE[0]
    loop for IND = 0 to len(UPCASELETTERS)-1
        SUBSTITUTE[IND] = SUBSTITUTE[IND + 1]
    end loop
    SUBSTITUTE[len(UPCASELETTERS)-1] = TEMP
end loop
```

**Example 4 (single loop)**

Award marks as follows up to **[5 max]**.

Award **[1]** for correct outer *for* loop (correct boundaries)

Award **[1]** for correct condition in *if* statement.

Award **[2 max]** for correct first assignment as follows:

**[1]** for using correct expressions of both indexes  $26 - (N - K)$  in

*SUBSTITUTE*, and *K* in *UPCASELETTERS*

**[1]** for using appropriate direction of assignment (*UPCASELETTERS* is used to rewrite into

*SUBSTITUTE*)

Award **[1]** for correct assignment of *SUBSTITUTE* in the other branch;

```
loop for K from 0 to 25
    if K < N
        SUBSTITUTE[26-(N-K)] = UPCASELETTERS[K]
    else
        SUBSTITUTE[K-N] = UPCASELETTERS[K]
    end if
end loop
```

**Example 5 (with mod)**

**Award [1]** creation/generation/instantiation of array *SUBSTITUTE* of length 26.

**Award [1]** correct main loop boundaries

**Award [1]** for fully correct mod expression in *IND*

**Award [1]** assignment of *IND* of mod expression

**Award [1]** correct assignment of values to *SUBSTITUTE*, via *IND* index.

```

loop for K from 0 to 25
  SUBSTITUTE[K] = UPCASELETTERS[K]
end loop
  // accept SUBSTITUTE = UPCASELETTERS or
  // SUBSTITUTE [K] = "A" or new array SUBSTITUTE

loop for K from 0 to 25 //main loop
  IND = (K+N) mod 26
  SUBSTITUTE[K] = UPCASELETTERS[IND]
end loop

```

**Remark:** no marks for calculations of indexes that can become negative.

**[5]**

(d) **Award up to [5 max].**

Search the array *UPCASELETTERS*;

Using a linear/sequential or binary search;

Search for the position/index of character *CH*;

If *CH* is found in *UPCASELETTER*;

Return the value stored in the array *SUBSTITUTE* at this position/index;

Otherwise return *CH*;

**[5]**

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