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Level 3 Technical Level
IT: CYBER SECURITY, NETWORKING, PROGRAMMING, USER SUPPORT
Y/507/6424

Unit 1 Fundamental principles of computing

Mark scheme

January 2019

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Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Level of response marking instructions

Level of response mark schemes are broken down into levels, each of which has a descriptor. The descriptor for the level shows the average performance for the level. There are marks in each level.

Before you apply the mark scheme to a student's answer read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1 Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer. With practice and familiarity you will find that for better answers you will be able to quickly skip through the lower levels of the mark scheme.

When assigning a level you should look at the overall quality of the answer and not look to pick holes in small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level and then use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 3 with a small amount of level 4 material it would be placed in level 3 but be awarded a mark near the top of the level because of the level 4 content.

Step 2 Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this. The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do not have to cover all of the points mentioned in the Indicative content to reach the highest level of the mark scheme.

An answer which contains nothing of relevance to the question must be awarded no marks.

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The following annotation is used in the mark scheme:

; - means a single mark

// - means alternative response

/ - means an alternative word or sub-phrase

A. - means acceptable creditworthy answer

R - means reject answer as not creditworthy

NE - means not enough

I - means ignore

DPT - in some questions a specific error made by a candidate, if repeated, could result in the candidate failing to gain more than one mark. The DPT label indicates that this mistake should only result in a candidate failing to gain one mark on the first occasion that the error is made. Provided that the answer remains understandable, subsequent marks should be awarded as if the error was not being repeated.

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Question	Guidance	Mark
01	a megabyte;	1
02	high level language;	1
03	interrupt;	1
04	accumulator;	1
05	accuracy;	1
06.1	Any **one** from: • American Standard for Information Interchange/ASCII; • UTF-8; • UTF-16; • Unicode; • EBCDIC; **A.** Mis-spellings that are slightly wrong but show correct knowledge **A.** Any other creditable answer	1
06.2	Guidance to examiners One mark should be awarded for answers that indicate the idea of storing binary representations. One mark should be awarded for understanding that this allows the correct interpretation of them by the computer. A computer cannot store 'letters' or 'numbers' or 'symbols'. It stores groups of binary digits; // Encoding allows letters, numbers and symbols to be stored as binary; The groups of binary digits can then be interpreted correctly as letters, numbers or symbols; **A.** Computer can only understand machine code;	2

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Question	Guidance	Mark
07.1	One mark for any of the following: • L1 cache is tied to a single core; • whereas L3 tends to be shared between multiple cores; • L3 is larger (because it services more than one core); • L3 has greater latency as it is furthest from CPU//L1 is quickest to access because it's on the CPU; • L1 cache is faster than L3 // L1 is extremely fast//L1 is slower than L3; • L1 is more expensive to manufacture//L3 is less expensive to manufacture; • L1 closest to the CPU//L3 is further away from CPU//L1 is on the CPU; • there is less L1 than L3//there is more L3 than L1; **A.** Any other creditable answer.	**2**
07.2	One mark for any of the following (max one mark for cache, one mark for RAM): Cache • needs to be fast; • holds next bit of data/instruction for CPU; • only needs to hold small amount of data; RAM • holds lots of data/instructions; • stores currently running programs; • so there needs to be lots of it; Cost • cache memory is relatively expensive//RAM is relatively cheap; **A.** Any other creditable answer	**2**
08	Up to two marks for explaining that different multiplication systems might be used: • binary definition/OSI/powers of 2; • decimal definition/ICE definition/powers of 10; Up to two marks for explaining the difference between the number of bytes in each system: • 1GB/gigabyte = 1 000 000 000 / 10^9 bytes; • 1 GiB/gibibyte = 1 073 741 824 / 2^{30} bytes; • because of formatting issues HDD space may not be reported exactly; • hidden partitions/space already being used for hidden system files; **R.** pre-installed software/bloatware/operating system unless qualified by one of the above points.	**4**

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<table>
<tr><th>Question</th><th>Guidance</th><th>Mark</th></tr>
<tr><td>09.1</td><td>
<table>
<tr><th>Input A</th><th>Input B</th><th>Input C</th><th>Access granted</th></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>
If all emboldened 0s and 1s are correct;
A. Correct logic but rows are not in correct order.
</td><td>1</td></tr>
<tr><td>09.2</td><td>Access is only granted if at least two of the inputs are TRUE;
A. Rows 1, 2, 3 5 of Table 1 are granted access;</td><td>1</td></tr>
<tr><td>09.3</td><td>One mark for each of the following:

A AND (B OR C);
B AND (A OR C);
C AND (A OR B);

If a combined expression equivalent to the above three is given, such as:

(A AND B) OR (A AND C) OR (B AND C);;;
A. Set notation;

A.B + A.C + B.C;;;
(A + B + C) >= 2;;;
A == B ? A : C ;;;
A. AND instead of ==

A ^ B ? C : A;;;
A. XOR instead of ^

Maximum of one mark if candidate has clearly recognised that all three of A, B, C have to be in the logical expression, but the expression is wrong.
If no logical expression is given then one mark may be awarded for an attempt to give a textual logical description (or pseudocode version) rather than a logical expression;</td><td>3</td></tr>
</table>

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Question	Guidance	Mark
09.4	One mark for each of the following • fingerprint scanner; • iris/retinal scanner; • ear-print scanner; • hand scanner; **A.** biometric measures, such as: • fingerprint (recognition); • iris/retina (recognition); • ear-print (recognition); • gait (analysis); • facial (recognition); • speech (recognition); **A.** Any other creditable answer	**2**
09.5	One mark for each of the following: • biometrics measure a measurable/recordable physical characteristic; • human beings have these measurable characteristics; • the characteristic is unique in each individual // virtually impossible to replicate characteristic; • checks if the individual being scanned is alive; • a computer program can authenticate an individual; • by comparing a reading against a stored value/record; **R.** examples that are shown above in 9.4	**4**
09.6	1 mark for each relevant point and each expansion to a maximum of 4. Points may include: • requires specialist input devices; • requires a record of all individuals that may need authenticating; • some individuals may not want their data stored (GDPR consent not given); • it is possible to replicate fingerprints//facial characteristics and fool the input device; • illness or injury may cause variation in the metric; • environment can affect the measurement (background noise// lighting// orientation to camera //clothing); • not 100% accurate // can decline to authenticate an authorised person//can authenticate a non-authorised person /false positive; • risk of coercion eg physical threats; • speed of recognition/response may be an issue;	**4**

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<table>
<tr><th>Question</th><th>Guidance</th><th>Mark</th></tr>
<tr><td>10.1</td><td>Maximum of three marks if only one type of computer is described.

One mark for each of the following:

<table>
<tr><th></th><th>Supercomputer</th><th>Personal computer</th></tr>
<tr><td>Size</td><td>tend to be very large;</td><td>small; portable;</td></tr>
<tr><td>Speed</td><td>extremely fast;</td><td>relatively slow;</td></tr>
<tr><td>Number of processors</td><td>large numbers;</td><td>tend to be single processor;</td></tr>
<tr><td>Power consumption</td><td>power hungry;</td><td>low;</td></tr>
<tr><td>Heat generation</td><td>very hot//
needs lots of cooling//
air-conditioned rooms;</td><td>run cool//air cooled;</td></tr>
<tr><td>Cost</td><td>extremely high;</td><td>very low;</td></tr>
<tr><td>Application</td><td>intensive number crunching applications;</td><td>general purpose applications;</td></tr>
<tr><td>No. of users</td><td>may be many;</td><td>generally a single user;</td></tr>
<tr><td>R.</td><td>more powerful</td><td>less powerful</td></tr>
<tr><td>R.</td><td colspan="2">type of organisation (eg bank, government, NASA) unless qualified by correct example of use</td></tr>
<tr><td>A.</td><td colspan="2">any other creditable answer</td></tr>
</table>
</td><td>4</td></tr>
<tr><td>10.2</td><td>One mark for each of the following:

• weather forecasting;
• environmental modelling;
• mining cryptocurrencies;
• smog control;
• automobile crash testing simulation;
• flight simulators;
• nuclear test simulation;
• big data application;
• Computer Generated Imagery (CGI) rendering for films;

A. Marks may be awarded for descriptions in 10.1 that have not already been awarded marks.

A. Any other creditable answer.

R. Simulation//big/complex calculations unless qualified by relevant example.</td><td>2</td></tr>
</table>

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Question	Guidance	Mark
11.1	One mark for each of the following methods (to a maximum of three marks): • air cooling; • water cooling; • heatpipes; • undervolting; • efficient arrangement of components in a computer; • optimal air flow techniques; • air cooling fins; • air cooling fans; • open loop water system; • closed loop water system; • heat sink/passive; • active; • liquid immersion/submersion; One mark for each advantage or disadvantage (to a maximum of four marks): • cost; • dust build up reducing effectiveness; • rate of heat transmission; • risk of leaking; • efficiency; **R.** Air conditioning of rooms/buildings. **R.** Immersion in water. **R.** Switching computer off.	**5**
11.2	One mark for each of the following: • as heat builds up components such as the CPU or GPU become stressed/operate less efficiently; • CPU throttling; • heat build-up can lead to the computer slowing down/ (CPU/GPU) failing completely // catastrophic failure, including fire; **A.** Overheating causes errors to occur;	**2**

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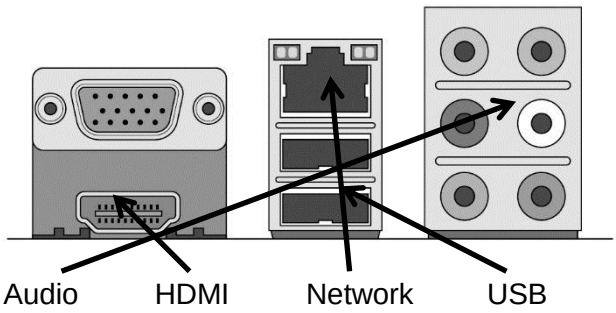
Question	Guidance	Mark
12	One mark for each of the following inputs or outputs (to a maximum of three marks): • import of / output to text files; • import of /output to csv files; • accessing data using web queries; • mail merge; • graphs and charts; • tables; • export to accounting software; • links to other workbooks; • links to other systems (such as SIMS); • access to web queries/programming commands; **A.** Any other creditable answer One additional mark for each expansion that describes/names what software will be integrated with the spreadsheet software.	**6**
13.1	One mark for each correct arrow/line  	**4**
13.2	One mark for each of the following: • installation of expansion card; • use of USB hub, powered or non-powered; • shared over a network; • attaching a device wirelessly; • attaching to (external) device (such as monitor) with USB port; One additional mark for a relevant expansion.	**2**

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<table>
<tr><th>Question</th><th>Guidance</th><th>Mark</th></tr>
<tr><td>13.3</td><td>One mark for each of the following points:

• (speed) USB 3.1 (10 times) faster than USB 3// USB 3 (about 10 times) faster than USB 2;
• (cost) USB 3 more expensive than USB 2;
• (colour) USB 2 is black or grey, USB 3 is blue;
• (shape) micro-USB connector different shape from USB 2 / 3;
• (current) increased power delivery in USB 3;

R. discussion of USB-A, USB-B, USB-C differences</td><td>2</td></tr>
<tr><td>13.4</td><td>
<table>
<tr><th>Marks</th><th>Description</th></tr>
<tr><td>5–6</td><td>Candidate has given a good technical description of both serial and parallel buses and what they do. Some correct examples show where buses can be found.</td></tr>
<tr><td>3–4</td><td>Candidate has given a brief technical description of serial or parallel buses and what they do. Some correct examples are given. The examples show where buses can be found.</td></tr>
<tr><td>1–2</td><td>Candidate has given some description of what a bus does; this may be more to do with purpose than technical detail. If examples are given they may indicate where buses can be found.</td></tr>
<tr><td>0</td><td>No creditworthy response.</td></tr>
</table>
Indicative content

Types of bus
• parallel (with parallel data lines and data transmission)
• serial (with serial data transmission)
• proprietary and common names for both

Locations
• internal, including CPU and motherboard
• external, including peripheral devices

Description of bus
• bus lanes
• connecting parts or devices
• bit communication
• communicating data/instructions</td><td>6</td></tr>
</table>

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Question	Guidance	Mark
13.5		16

Marks	Descriptor
13–16	Candidate has described a range of options. Some advantages and disadvantages of each option are discussed. There is a good technical description of how the storage works.
9–12	Candidate has described a range of options. Some advantages and disadvantages of each option are explained. There may be a brief description of how the storage works.
5–8	Candidate has briefly described more than one option. The advantages and disadvantages are briefly described.
1–4	Candidate has named one or more options. Some advantages and/or disadvantages may be stated.
0	No creditworthy response.

Indicative content:

Options:

internal expansion
external addition
HDD
SSD
Hybrid HDD/SSD drives
cloud storage
USB sticks
card storage (eg SD)
Network Attached Storage (NAS)

Advantages and disadvantages:

capacity
speed of access and writing
heat output
availability eg cloud storage requires Internet access, external HDD needs to be plugged in)
cost
ease of expansion
ease of use
portability
technical knowledge necessary

How it works

physical mechanism
virtual storage
electronic mechanism
hybrid