

Paper I (Section A)

Question No.	Key	Question No.	Key
1.	C (68%)	21.	A (70%)
2.	B (67%)	22.	A (47%)
3.	A (62%)	23.	D (80%)
4.	D (55%)	24.	C (65%)
5.	B (81%)	25.	B (88%)
6.	A (88%)	26.	D (81%)
7.	A (48%)	27.	B (73%)
8.	D (79%)	28.	B (33%)
9.	B (61%)	29.	C (87%)
10.	D (56%)	30.	A (66%)
11.	C (38%)	31.	C (73%)
12.	D (24%)	32.	C (80%)
13.	C (65%)	33.	B (79%)
14.	C (45%)	34.	D (67%)
15.	B (64%)	35.	C (49%)
16.	A (47%)	36.	A (83%)
17.	C (89%)	37.	D (93%)
18.	A (86%)	38.	B (72%)
19.	D (60%)	39.	B (81%)
20.	B (81%)	40.	*

This item was deleted.

Note: Figures in brackets indicate the percentages of candidates choosing the correct answers.

General note on Item deletion

It is normal for the HKEAA to delete a small number of items from its multiple-choice question papers if they prove unsatisfactory. In practice, there are a number of reasons why this is considered necessary. By far the most common reason for deleting an item is that the item fails to discriminate between weak and able candidates – in other words, the majority of the candidates involved had to rely on guesswork in answering that question. If such an item is retained, the assessment process is rendered less effective. Where items have been deleted in the live papers, they are still included in the series of publications. They are indicated as deleted items. Such items may be discussed in the corresponding examination reports.

paper 1 (Section B)

	Marks
1. (a) (i) Touch screen: It is easy for students to operate. / It occupies less space. / It makes for easier hand-eye coordination.	1
Keyboard and mouse: The way that students could input is diversified (e.g. mouse-over) / The input speed could be faster. / The cost is lower. / It is more ergonomic friendly.	1
(ii) Speaker (headphone) – Pronounce English vocabularies. / Play videos.	1
(b) A network interface card is installed in each workstation to manage the data sent and the data received through the network cables.	1
Network cables are the communication links between the network interface cards and switches. Switches are used to manage the data transmission between the workstations and servers .	1
(c) The learning materials contain multimedia elements that can help students learn better. The learning progress can be tailor-made for individual students during the learning process. The learning progress can be interactive (e.g. searching) that can help students learn better. Appropriate feedback or response can be delivered instantly.	1×2
(d) (i) Students can check a number of their email accounts in one go. / Students can create a copy of email in another email account for backup.	1
(ii) Minimise the size of the email in transmission or storage. / The size of the email can be neglected.	1
(iii) The hyperlink may become invalid due to a structural change or update in the platform after a period of time.	1

2. (a) (i) The virus definition will be updated.
 Some additional features will be provided.
 Some program bugs will be fixed.
 The old version of the software may not be compatible to the OS of the computer any more.

- ✗ It keeps the software in a good condition to protect the computer.
- ✗ It protects the normal operation of the computer from computer virus.
- ✗ After the update, it can scan computer virus in detail.

- (ii) Peter can install a firewall in the school network to prevent students from installing unauthorised programs / prevent hacking / authorize network traffic / authenticate users / encrypt data transmission / support network segmentation / fix security vulnerabilities / support logging and security audit / block some IP addresses from harmful web sites.
(Reference: IT Security Guidelines, OGCIO)

- (b) (i) Batch processing: Peter collects and accumulates tasks for a period of time and does all in one go.
 ✗ Peter will work at specific time and location such as Saturday morning.
 ✗ Peter can install software at the fastest speed.

- (ii) Linux fully supports a command line interface while the others do not. (different user interface)
 Mac OS usually only run on proprietary hardware. (hardware support)
 They have different types of software licence. (licence)
 They have different types of memory management methods. (memory management)
 They have different types of file management methods. (file management)
 ✗ different types of programming language support/used, ease of use, types of application software on the platform, support from the OS companies / communities

- (c) (i) Education, age, disability, geographical location, household size and type, gender, racial
(Reference: <https://stats.oecd.org/glossary/detail.asp?ID=4719>)

- (ii) Improve the access to ICT equipment (hardware)
 Improve the access to the Internet
 Improve the access to ICT knowledge (learning)
 ✗ Educate the public that the benefit of technology and how technology can help improve human lives.

	Marks
(a) AVI: It supports a better video quality. MP4: It supports a smaller file size of video. / It is compressed. / It supports streaming. / It supports more portable devices/operating systems. (HTML5 supports MP4 only) / It supports subtitle / menu.	1
The number of hours = $60 * 1024 / 11 / 60$	1
(b) = 93 (93.1 / 93.09 acceptable)	1
(c) (i) Compression has been already applied to the videos because of their video format.	1
(ii) Concept of fragmentation for hard disk ① (e.g. It rearranges the data fragments close together.) Effect of the rearrangement of data fragments ① (e.g. It speeds up the access of files./ It does not increase free space./It does not change the file size)	1
(iii) Use a different video compression method with a lower frame rate / a lower image resolution / a higher compression ratio / a smaller colour depth..	1
(d) Videos can be instantly played on clients without downloading the entire video. / It saves storage space as there is no need to store the entire videos. Limitation (e.g. bandwidth, download speed, network traffic, stable Internet connection, number of clients, it does not support AVI, video cannot be downloaded for later watching)	1
(e) Yes, sender can encrypt the message with the receiver's public key and the receiver can decrypt the message by his own private key. ① the use of encryption / key ② correct use of public key and private key(receiver's public key to encrypt and receiver's private key to decrypt)	2*

4. (a) There are two identical teacher names (Greg Li) in the last two records.

SUM GROUP

(b) A 90
B 35

(c) (i) 10102

(ii) Type check (character)
Range check
Presence check

(iii) Double entry, printout for checking.
Verification

(d) (i) ~~AVERAGE(D2:D6)~~

(ii) ~~COUNTIF(C\$2:C\$6, C11)~~
 COUNTIF()

(e) at least one page for each activity
 a clear heading/topic on each slide
 proper design for slides with text & images

5. (a) Any integer small than 1 or greater than 100

Any integer between 1 and 100 inclusive, except 19
19

(b) (i) GUESS < ANSWER
GUESS > ANSWER
K + 1
K = 5 or K > 4 or K >= 5

(ii) As the loop may end due to K = 5, which does not mean the user wins. Even if a user cannot correctly guess the answer, the message will be displayed anyway.

(c) (i) Other people can
- freely use the program
- change the program code to improve the game (read/modify)
- freely distribute the game

(ii) Control the brightness of the screen. (filter)
Enlarge the font size. (accessibility function)
Use voice input/output.

Marks

1

2

1

1x2

1

1

2

3

1

1

1

1

1

1

1x2

1x2

* Marking criteria

Illustrate a comprehensive and logical answer

Illustrate a relevant answer

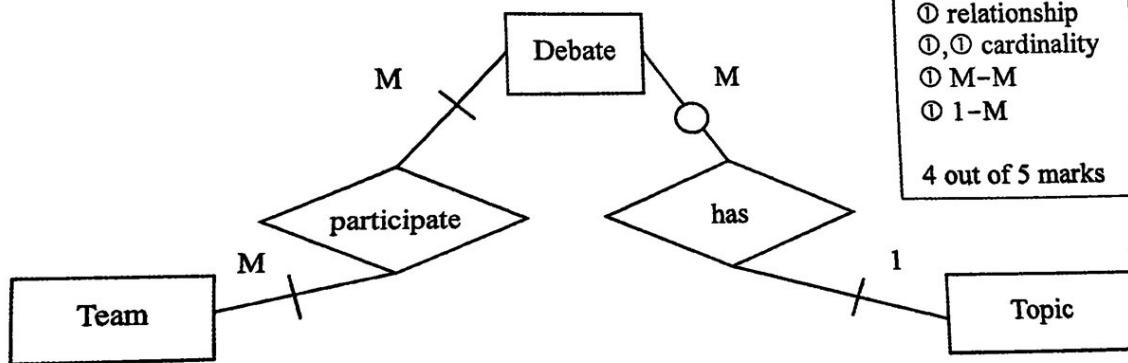
	Marks
1. (a) (i) CONID / MID	1
(ii) A team name (e.g. Rockets) may be stored in several records in DEBATE.	1
(b) (i) DEBATE2 (MID, PROID, PROM, CONID, CONM, DD, TD) ① Primary key: MID Foreign key: PROID, CONID] ① TEAM(TID, TNAME) ① Primary key: TID Foreign key: N/A] ①	5

TID and TNAME represent the identity code and the name of a school team respectively. ①

- (ii) Yes, as all non-key attributes are fully functional dependent on their primary keys (no partial dependencies) ①
and there is no functional dependency between the non-key attributes (no transitive dependency), the design should be in 3NF. ①

✗ Just mention 2NF ①

(c)



① relationship
 ①,① cardinality
 ① M-M
 ① 1-M
 4 out of 5 marks

- 3) video format, processing time, bandwidth, spatial constraints, streaming technology

1×3

		Marks
2. (a)	SELECT SNAME, PNAME FROM STUDENT, PARENT WHERE STUDENT.FID = PARENT.PID	① ①
(b)	SELECT COUNT(*) FROM STUDENT GROUP BY SL	① ①
(c)	SELECT PNAME FROM PARENT WHERE PID NOT IN (SELECT AID FROM ALUMNUS)	① ① ①
	Alternative: SELECT P.PNAME FROM PARENT P WHERE NOT EXISTS (SELECT AID FROM ALUMNUS A WHERE P.PID = A.AID)	① ① ①
		LEFT JOIN ✓
(d) (i)	SID, SNAME, 2018 SL = 'S6'	double quota ✓ 1
(ii)	Delete the records from STUDENT which have just added to ALUMNUS and delete corresponding records from PARENT (records whose parents do not have other children studying there).	1 1
(e) (i)	CREATE VIEW MA AS SELECT SID FROM STUDENT S, ALUMNUS A WHERE S.MID = A.AID	①] ①
(ii)	SELECT SID FROM MA MINUS SELECT SID FROM FA	①, ① All correct 2
	Alternative: SELECT DISTINCT MA.SID FROM MA LEFT OUTER JOIN FA ON MA.SID = FA.SID WHERE FA.SID IS NULL] ①, ① All correct

		Marks
3.	(a) 1 8 2 5	1×4
(b)	Database administrator (other reasonable answers)	
	Database developer (Database programmer/designer)	
(c)	Database: They may use different database models such as the relational model and hierarchical model. (network/graph/multi-value/object-oriented models)	1, 1
	Schema: They may use different database schemas such that - overlapped elements in the schemas should be included, - independent entities/relationships should be excluded, and - no dependent entities/relationships are dropped.	1
	Data type: For the same kind of data such as an item code, they may use different data types such as character and integer to store the data.	1
(d)	(i) - Appropriate fields included - Appropriate design features such as the use of drop down menu - User-friendly	1×3
	(ii) - customer history - calculation/estimation of existing data	1×2

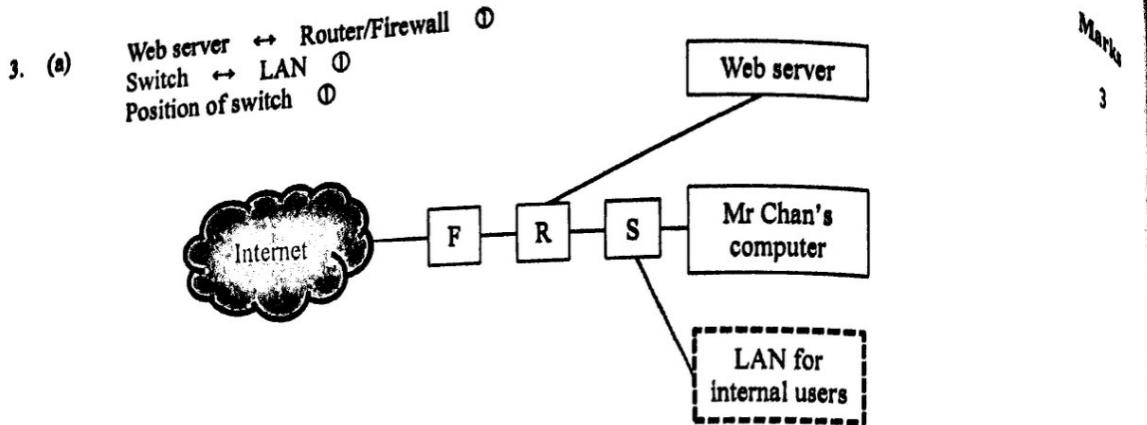
	Marks
4. (a) (i) Transfer \$200 from account with AID 'BZ0001' to the account with AID 'BZ0002'.	1
(ii) There would be a data integrity problem whenever there is a system crash in the middle of the execution as it needs both commands to complete a task successfully. Account with AID 'BZ0001' will be minus \$200 but account with AID 'BZ0002' does not receive any money.	2*
① Identify the problem (data integrity)	
(b) <u>DELETE FROM ACCOUNT WHERE AID = 'BZ0003'</u>	2
N/A	1
(c) (i) Method 1 The execution will be faster as several servers can share the workload.	2*
(ii) Method 2 It is difficult to update different copies at the same time that may risk the data integrity.	2*
(d) (i) Find all the identity codes of the accounts whose customers pay more than two times. (more than two transactions)	2
(ii) SELECT PID FROM TRAN GROUP BY PID HAVING COUNT(*) > 2	3

* Marking criteria

② Illustrate a comprehensive and logical answer

① Illustrate a relevant answer

		Marks
1.	(a) (i) It is higher throughput (for a fixed physical size). (bandwidth) It has less signal degradation. There is less interference. It has lower power consumption. (ii) Satellite communications (microwave) Oil wells are at remote sites where no underwater cables are in service.	1×2 1 1
	(b) (i) In the simplex communication mode, data travel only in one direction (unidirectional communication). In the duplex communication mode, the two parties can communicate with one another in both directions (bidirectional communication). (ii) Simplex: Equipment in the oil wells sends out status data to a server in the offices in the cities. Duplex: Carry out video conferencing between two staff members.	1 1 1 1
	(c) (i) Z (ii) ① even numbers of error bits + ① example (an illustration of the same parity bit) (iii) CRC (循環冗餘核對) /checksum	1 2 1
	(d) Check the channel to ensure being clear before sending a packet. Otherwise wait for a random period of time (backoff factor/backoff counter). The steps are repeated until all packets are sent.	① ① 2
2.	(a) The network card connecting to the Internet: 210.0.205.213 Others: 192.168.1.1, 192.168.1.2, 192.168.1.3, 192.168.1.4, 192.168.1.5	① ① 2
	(b) (i) The power consumption is lower. Due to a shorter reception range, it is not easy to be intercepted / it does not interfere with other users. (ii) It supports a connection with a longer distance.	1 1
	(iii) It supports a connection with a long distance. (longer transmission range) An obstacle cannot directly disrupt the connection. It supports user authentication.	1×2
	(c) (i) A VPN can be set up such that users can <u>remotely access the devices</u> at the smart home. With the use of IPsec, <u>the network security threats</u> (encryption) can be minimised. (ii) A PAN can be set up within a smart home such that data can be transmitted between the computer and the other devices without the use of switches and routers. The readings of the devices can be gathered and analysed for improving the living. (① connection ① application)	2* 2*
	(d) (i) IPv4: 2^{32} or $4.3 \times 10^9 < 2^{34}$ IPv6: 2^{128} or $3.4 \times 10^{38} > 2^{34}$	1 1
	(ii) It supports for new services such as Quality of Service (QoS). / It supports more efficient routing. (reduce the size of routing table) / It supports more efficient packet processing. (simplified header) / Even if the packet body is encrypted, the header is not encrypted and QoS can prioritise packets carrying real time applications like video or audio.	2*



- (b) (i) Network engineer: Work on the design / installation / troubleshooting of networks.
 Network administrator: Work on the maintenance / management of networks / Keep network secure from security threats. 1
- (ii) functional test (e.g. Use PING function to test the connectivity)
 load test
 security test
 (other kinds of categories) 1x2
- (iii) No, the main service of the system is uploading photos while the proxy server can only help internal users for web surfing. /
 No, the bottleneck is on the broadband and a proxy server can help the response of the web server only for users in the intranet for caching the web content. 2
- (c) (i) Two 3TB hard disks are used under RAID 1. (RAID 1, 5, 6, 10)
 Using a hard disk as a mirror of the other one. 1
- (ii) Fire or other unexpected events might happen.
 There is only one physical location where the file server/NAS with RAID stores the data files.
 It is better to create backup of the data files in another location / cloud storage. 1
- (d) (i) No, only one key is used. / Yes, hacker holds the private key.
 In a public and private key encryption system, two keys are in use. For example, a sender use a public key to encrypt a message and the receiver can decrypt the message using a private key. 1
- (ii) Create full backup regularly and keep the copies for a longer period of time.
 Do not allow installing software without a thorough examination of the source of the software. 1x2

		Marks
(a) (i)	a switch connecting the two schools a router connecting the switch to the Internet	1
(ii)	a router connecting the primary school with the Internet a router connecting the secondary school with the Internet	1
(b) (i)	- increase security options - simplify the network administration - prevent unnecessary broadcasts - control the growth of the numbers of hosts	1×2
(ii)	Example: 172.16.1.1 – 172.16.1.254 255.255.255.0 172.16.2.1 – 172.16.2.254 255.255.255.0	1×4
(c)	Advantage: It also allows many devices to share limited address space on a network if only some devices will be online at a specific time. / It saves cost on allocating IP addresses to network devices. Disadvantage: The DHCP server can be a single point of failure in networking environments when there is only one DHCP server. An incorrectly defined configuration will affect all DHCP clients in one go.	1
(d) (i)	There is a bottleneck in the router.	1
(ii)	Relocate the video server to the computer classroom such that students can access the video server without passing through the router to alleviate the loading on the router. (Or change the connection.)	2*
	① action ② explanation	

*Marking criteria
 ① Illustrate a comprehensive and logical answer
 ② Illustrate a relevant answer

Paper 2C

Marks

1x2

1. (a) Many portable devices support GIF. / No plugin is required for GIF. /
 GIF is less likely to create security problems. / Many major browsers will not support SWF by
 2020 (Adobe will stop updating Flash Player in the end of 2020). /

It is easy to create transparent images.

✗ smaller file size, more colours

✗ it is easier to create GIF image

✗ no special software is needed

✗ attributes applied to GIF such as lossless compression, which are irrelevant

$$(b) (i) \frac{30 \times 60 \times 4096 \times 2160 \times 30 \times 12}{①} \div 8 \div 1024 \div 1024 \div 1024$$

$$= 667 \quad (-717)$$

$$(ii) \frac{30 \times 60 \times 40 \times 1000 \times 1000}{①} \div 8 \div 1024 \div 1024 \div 1024$$

$$= 8.38 \quad (-9)$$

$$\times 9.437184 = 30*60*40*1024*1024/(8*1000*1000*1000)$$

- (iii) Combine the first two buttons into a new button that Play and pause functions can be toggled.
 ✗ state the combination of two buttons without elaboration

1

- (iv) Change the display size. / Display subtitle or annotation of the video. /
 Control the volume of the video.

1x2

✗ replay

✗ share video hyperlink

✗ download / record / screen capture

- (c) (i) The file size of the web page is smaller. (storage)

1x2

It is easy to edit the content of the formula. (reusability)

It is easy to change the font style (e.g. font size) of the text. (format)

✗ easy to copy

✗ no need to create graphic

✗ for screen reader

- (ii) Add alternative text to the formula. / Embed audio in the formula. (description of the formula)

1

- (d) (i) Define the keywords of the web pages to facilitate web searching.
 Search engine

1

- (ii) Define the character set for the content of the web page.
 Browser

1

1

	Marks
(a) It can ensure that the text boxes are not empty. / It can ensure that the username does not contain invalid characters such as space characters. / It can ensure that the password is long enough / includes required types of characters. (presence check / format check / range check / limit check / type check / length check) x check digit	1×2
(b) (i) The online system might encounter a server loading issue. / Server performance becomes slower. / Confidential information might be leaked.	1×2
(ii) Use Captcha (reCAPTCHA) / security questions / two-way authentication (one-time password) / to ensure that robots are not on the client side. / Limit the number of failed login attempts.	1×2
(c) (i) It seems that students can choose more than 5 activities. It seems that there is no control on identical priorities. There are too many activities to be chosen and it is difficult to navigate.	1×3
(ii) Tackle each problem $\times 3$ Effective description	4
(d) The lines for Volleyball and Handball (values in year 2015) cannot be identified. Add small figures such as squares, triangles and circles on the lines to illustrate the sports. / Use different types of line such as dotted line to illustrate the sports.	1 1
 1. (a) (i) Case 1 (Bandwidth) The layout is simplified with fewer text and images in the mobile version as the download speed is slower. ✓ The file sizes of multimedia files should be smaller. ✓ There are fewer multi-media files. / The print button is only shown in the desktop version. x The mobile version is simpler while the desktop version is comprehensive. x There are fewer functions and it presents less information. x The formats of multimedia files are different.	1×2
 Case 2 (Small screen size) The attributes of the content such as font size is adjusted to fit the small screen size of mobile devices. ✓ Image size x The resolution of the mobile version is lower.	
 Case 3 (Screen layout) The orientation / aspect ratio of the screen is different. ✓ Navigation (vertical vs horizontal)	
 Case 4 (The user interface, mouse vs touch) Use more scrollbars and buttons instead of hypertext in the mobile version. ✓ Button design ✓ Minimise the use of pull-down menu. ✓ The font size becomes larger. ✓ Mobile phone functions such as GPS are integrated. x The navigation bar will state on top. x The mobile version does not include plug-in. x The hyperlinks of web sites will be different in the mobile version. x The compatibility / operating system is different.	

Marks
1x2

(ii) Case 1 (The printout is more viewable in terms of layout.)

✓ Adjust the margins for printing on paper.

✓ The content is adjusted to one page for printing.

✗ The aspect ratio is different.

Case 2 (Only the necessary information is kept for printing.)

Remove unnecessary images/ menu/ animation/ video.

✓ The navigation bars and advertisement banners are removed.

✗ No hyperlink in the print version

Case 3 (related to the printout)

✓ Adjust the contrast.

✓ The background colour is not applied to the print version for saving toner.

✓ Adjust the paging. / Page separation in print version

✗ The desktop version is more user-friendly.

✗ The information such as date and temperature cannot be updated in the print version.

(iii) Personalised information such as temperature at users' location can be displayed.

✓ The temperature and humidity on the top left corner will be shown according to the location.

✗ Provide real time information

1

(b) (i) Setting 2 supports CD quality. ('good audio quality' + one reason such as higher sampling rate, larger sample size or more channels)

✓ As Setting 2 has one more channel than Setting 1, it leads to a better audio quality.

✗ Peter should choose Setting 2 as it is good at sampling rate, sample size and number of channels.

✗ The sampling rate is out of the limit of human hearing.

1

(ii) Setting 2 supports a smaller file size.

✓ The downloading time is shorter under Setting 2.

✗ The sampling rate in Setting 3 is out of the limit of human hearing / too high.

✗ The sampling rate in Setting 3 cannot be supported.

✗ It is not necessary to apply a high sampling rate to the background music as it will affect the transmission of weather reports.

1

(iii) $(20 \times 1024 \times 1024) \div (441 \times 1000) \div (16 \div 8) \div 2$

①

1,1

= 119 s

Alternative 1:

$(20 \times 1024 \times 1024 \times 8) \div (441 \times 1000 \times 16 \times 2)$

= 118 s or 1.98 min

Alternative 2:

Or $(20 \times 1024 \times 8) \div (441 \times 16 \times 2)$

= 116 s or 1.93 min

Alternative 3:

Or $(20 \times 1000 \times 1000 \times 8) \div (441 \times 1000 \times 16 \times 2)$

= 113 s or 1.88 min

(2 marks for correct answer)

✗ Use other setting

✗ round up figures

- (c) 2
3
3
4

1

1

1

1

4. (a) (i) $256^3 / 2^{24} / 16^6 / 16,777,216$ Marks 1
 $\times 255^3 / 16,777,215$

(ii) Scheme 2 should not be used because the colours of the text and background are similar and it is difficult to distinguish the text and background. 1 +1

* The text and background are similar (without mentioning the colours)

(b) The file size is small for the images that mainly involves line drawing. 1×2
The images can be scaled to any size without loss of quality.

- * It is easier to create/edit vector graphics (irrelevant)
- * The image can be enlarged (without mentioning the quality)
- * Vector graphics make jagged edges less noticeable. (without mentioning the scaling)
- * Vector graphics are smaller (without mentioning the file size)
- * Vector graphics support interactive elements.
- * Vector graphics do not affect the resolution after enlargement.
- * Vector graphics contain more colours.
- * Vector graphics have a better image quality.

(c)  6
Repeat

```
B ← myrand / myrand() / (other random function, e.g. rnd)
C ← myrand / myrand() / (other random function, e.g. rnd)
display "A = ?"
input A
if A = C - B then
    display "Correct!"
    N ← N + 1
else
    display "Incorrect!"
until N = 10
display "You have correctly answered 10 questions!"
```

Generate multiple random questions

Assign random numbers to B and C ①
Try to repeatedly assign random numbers to B and C ①

Check the answers

Check A=C-B condition ①
Display either "Correct" or "Incorrect" messages ①
Store/count the number of correctly answered questions ①

Stop the loop after 10 questions have been answered correctly

Exit condition for the loop (e.g. while N<10) ①
* Number of loop is pre-defined

Marks

1+1

- (d) Cookie should be used. The preferences will be stored in cookies on the client side every time players update their preferences. Hence, when players visit the web page again, their preferences will be retrieved from the cookies.

- ✗ Client-side script / JavaScript / Store in the browser/account (too general)
- ✗ Auto-save function
- ✗ Use 'remember me' function

- (e) Send the time needed to the server. Retrieve players' information (rank list) from a database to sort the time. Send the ranking order back to the client side and display the rank list.

Server side / server / database
Upload data/time
Sort/compare/order/arrange in order / from small to large (time)

① +
①
①

1 + 1,1

- ✗ Server sends time of all players to the client side. Browser uses the data on the client side to get the rank.
- ✗ Arrange the time (too general)
- ✗ Find the rank
- ✗ Sort the name
- ✗ Sort the ranking

	Marks								
1. (a) (i)	1								
<table border="1"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td> </tr> </table>	0	0	0	0	0	0	1	0	
0	0	0	0	0	0	1	0		
(ii)	1								
<table border="1"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td> </tr> </table>	0	0	0	0	1	0	0	0	
0	0	0	0	1	0	0	0		
(iii) Add 1 to the number represented by A.	2								
(b) (i) Boundary cases testing test the extreme values of the input domain, e.g. maximum, minimum, just inside/outside boundaries to ensure the program is correctly implemented as normal cases.	1								
(ii) Case 3. When add 1 to the maximum value (255), the final value (256) cannot be represented by A. It confirms the largest value that can be represented is 255 and the program should be able to handle this special case.	1 1								
(c) (i)	1								
<table border="1"> <tr> <td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>0</td> </tr> </table>	0	0	0	0	0	1	1	0	
0	0	0	0	0	1	1	0		
(ii) Add m to the value in A.	1, 1								
(iii) A with n = 8 cannot store a value as large as 1000.	1								
(iv) Since $1000 < 2^{10}$, enlarge the array size n from 8 to 10. The minimum size of A should be 10.	1 1								

	Marks
2. (a) (i) 312, 294	1
(ii) Advantage: It occupies <u>less storage space.</u> ① Drawback: When taking average values, the <u>original data cannot be reinstated.</u> ① Some original data will be missing.	1
(b) 1-2 3-4 5-6 7-8 420 425 ① 430 430	2
(c) interviews, surveys, questionnaires	1 ②
(d) (i) Both the original version and the upgrade version <u>run simultaneously</u> for some period of time. After which, if the criteria for the upgrade version are met, the original version is disabled. The <u>risk</u> of the conversion is <u>low</u> .	1
(ii) The original version is <u>instantly changed</u> to the upgrade version on a given date. The <u>cost</u> of the conversion is <u>low</u> . / Parallel run is not feasible in certain scenarios.	1
(e) (i) The object-oriented style is that a program is presented by <u>objects/ classes/methods</u> with the use of <u>encapsulation, inheritance and polymorphism</u> . The procedural style is that a program consists of <u>a main program/a sequence of instructions</u> to be executed in the order designed by the programmer.	1
(ii) The library provides many suitable, <u>ready-to-use</u> subprograms for Mary and other programmers to develop their own programs. It will <u>facilitate/shorten/speed up</u> the application development time significantly.	2*
(iii) It is <u>not necessary to compile</u> a source code in advance. An interpreter will <u>translate a source code</u> into immediate instructions/efficient intermediate representation and <u>immediately execute</u> it.	2*

		Marks
3. (a) (i)	function hasCap: boolean; var i : integer; temp : boolean; begin i := 1; temp := false; repeat if (P[i] >= 'A') and (P[i] <= 'Z') then temp := true; i := i + 1; until temp or (i > N); hasCap := temp;	① } ① ①
	end;	
(ii)	function noSpace : boolean; var i : integer; temp : boolean; begin temp := true; for i := 1 to N do if (P[i] = ' ') then temp := false; noSpace := temp;	① ① ①
	end;	① all correct
(b)	function checkPassWd : boolean; begin checkPassWd := hasCap and noSpace;	① ①
	end;	
(c) (i)	3	1
(ii)	100	1
(d) (i)	The way to search for the password is not changed. On average the number of passwords to be visited in the list is still 50 ($n/2$).	1
(ii)	The subprogram can stop the loop when it is confirmed that the password cannot be found in the remaining items in the list with the use of a sorted list. On line 6, $(FP[i] <> PASSWORD)$ should be changed to $(FP[i] < PASSWORD)$.	1 1
(e)	$2^6 < 100 < 2^7$, or $\log_2 100 = 6.64$ The maximum number of string comparisons = 7.	1 1

- Mark
2
3
4
2
2
2
4. (a) $10 \times 10 \times 1, 8 \times 8 \times 1, 4 \times 4 \times 1, 2 \times 2 \times 1$ (any 2 exists ①) (exactly correct ②)
- (b) for Y from 1 to 10 do ①
 for X from 1 to Y do ①
 print a cube at the position (X, Y) ①
- Alternative:
 for X from 1 to 10 do ①
 for Y from X to 10 do ①
 print a cube at the position (X, Y) ①
- (c) $10 - 2 \times k$ ①
 K ①
 10 ①
 k+n+1 ①
- (d) a $2 \times 2 \times 2$ cube ②
 a $2 \times 2 \times 1$ layer ①
- (e) (i) for j from 1 to 10 do ①
 HollowSQ(2) } ①
 MUP }
- (ii) for j from 0 to 4 do ①
 SQ(j) } ①
 MUP }

try to create outer loop ①
 try to create inner loop ①
 print a cube ①

* Marking criteria
 ② Illustrate a comprehensive and logical answer
 ① Illustrate a relevant answer