Paper 1 (Section A)

Question No.	Key	Question No.	Key
1.	C (37%)	21.	C (81%)
2.	A (18%)	22.	B (83%)
3.	C (59%)	23.	A (58%)
4.	C (65%)	24.	C (75%)
5.	D (83%)	25.	A (78%)
6.	B (79%)	26.	B (50%)
7.	D (83%)	27.	D (87%)
8.	A (39%)	28.	B (72%)
9.	A (97%)	29.	A (88%)
10.	D (51%)	30.	D (69%)
11.	D (60%)	31.	B (47%)
12.	D (34%)	32.	B (72%)
13.	C (59%)	33.	A (57%)
14.	A (87%)	34.	C (93%)
15.	B (76%)	35.	D (72%)
16.	B (58%)	36.	B (66%)
17.	A (61%)	37.	D (83%)
18.	C (78%)	38.	C (85%)
19.	D (39%)	39.	C (45%)
20.	B (60%)	40.	A (94%)

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

Paper 1 (Section B)

				Marks
1.	(a)		The photos are kept from damage during the production. The photos can be returned to Alumni afterwards, without keeping it for a long period of time. Quality of the photos can be improved by software.	1×2
	(b)	(i)	The file size is smaller. / It supports compression. / It supports most browsers.	1
		(ii)	It has higher quality in terms of the number of colours displayed. / The file size is smaller. / It has a higher compression ratio.	1
	(c)	(i)	Resolution (dpi/ppi), colour depth, file format (compression ratio)	1×2
		(ii)	There is no character in the photos to be recognised.	1
	(d)		naming of files (with activity names), folder structure	1×2
	(e)	(i)	Her computer might be infected by malware (virus, adware, ransomware, etc.) upon installation. The software may not be the updated version. The source of the software might not be legitimate and Susan might violate the intellectual property rights of the software company.	1×2
		(ii)	She can acquire more proper technical support.	1
2.	(a)		POP3 and IMAP are email protocols. It is convenient to synchronize email with IMAP when users read email by different devices. / With IMAP emails can be re-organised and put in folders. (file system) [× For POP3, emails are downloaded from a server to a single computer and then removed from the server. / Save storage space]	1, 1 1
	(b)		Translate the domain name into its IP address.	1
	(c)		Malicious code might be spread onto Charles' computer. / Charles' computer will be attacked through program bugs of browser. (virus infection) Spammers will know that Charles responds to the spam mail and then send him more spam mails. (spam mail) It links to web sites that Charles does not intend to visit. (phishing)	1×2
	(d)	(i)	2	1
		(ii)	`LOTTERY, HELLO` They are one correct string and one incorrect string to validate the algorithms.	1 1
		(iii)	ALG2 is more efficient as it has not gone through all strings in `ST`.	2*
		(iv)	It is easy to implement a loop to check all strings.	1

			Marks
3.	(a)	Solution P: Do not depend on the Internet connection. / The response time of the software is faster. / It has a better security control.	1×2
		Solution Q: The installation is simple. (no installation) / It can provide up-to-date functions. / It provides backup service.	1×2
	(b) (i)	Memory cache: Store frequently-used program instructions/data. Bus system: It is a communication system that transfer data between major components of the server.	1 1
	(ii)	RAM, CPU, RAID controller, NIC ✗ROM	1×2
	(c)	consistent user interface → increase the efficiency colour mix, font size, contrast → display images/text in a comfortable manner	1×2
	(d)	The cost is higher. More time is needed to prepare for the implementation of the solution.	1 1
4.	(a) (i)	a number (product ID)	1
	(ii)	the toy information such as its toy name, price, category and stock	1
	(iii)	Database of the POS system	1
	(iv)	quiet in operation / smaller in size / shorter printing time	1×2
	(b) (i)	`=IF($B3>=$B$1, 1,0)` ① addressing	1,1
	(ii)	Select data range: `A2:B42` (or `A3:B42`) Choose chart type: Bar chart, Column chart, Line chart Set two chart properties: title, legend, axis title, data label	1×3
	(c)	① Date in row ① Store and/or Store manager in the column ① Summary information (e.g. total net profit)	1×3

				Marks
5.	(a)	(i)	Flash memory should be used as it is light in weight. (small in size, anti-shock, portable or low power consumption)	1+1
		(ii)	Bluetooth: It has low power consumption. / It involves simple technology. / It supports peer-to-peer network connection. Wi-Fi: It supports a high data transfer rate. / It provides larger network coverage.	1
		(iii)	The weight of the device The battery life of the device	1×2
	(b)	(i)	74,898	
		(ii)	It is not unique.	
		(iii)	`PDATE` or `CUSTNO+PDATE`	
	(c)		44 1-2-2016 10:10 48 21-11-2015 12:20	2

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

Paper 2A

Marks

1. (a)

```
SELECT VID FROM ACT
WHERE VNAME LIKE "%flag selling%"    (or  "*flag selling*")
ORDER BY VDATE DESC
```

2

① 2nd or 3rd line
① all correct

(b)

```
SELECT VNAME
FROM ACT
WHERE MONTH(VDATE) BETWEEN 1 AND 3 AND YEAR(VDATE) = 2016
```

3

① MONTH condition
① YEAR condition
① all correct

(c)

```
SELECT MNAME
FROM MEM
WHERE MID NOT IN (SELECT MID FROM APP)                    ②
```

3

① all correct

Alternatives:

```
SELECT MNAME
FROM MEM LEFT OUTER JOIN APP on MEM.MID = APP.MID
WHERE VID IS NULL
```

```
SELECT MNAME FROM MEM
MINUS
SELECT MNAME FROM APP as A INNER JOIN MEM as M on M.MID = A.MID
```

(d)

```
SELECT A1.VID
FROM ACT as A1
WHERE A1.QUOTA > (SELECT COUNT(*) FROM APP WHERE A1.VID=APP.VID)
      ①                ①
```

3

① all correct

Alternative 1:

```
SELECT ACT.VID
FROM  ACT LEFT JOIN APP ON APP.VID=ACT.VID
GROUP BY ACT.VID                                          ①
HAVING COUNT(MID) < AVG(QUOTA)
```

Alternative 2:

```
CREATE VIEW CNT
AS (SELECT ACT.VID, COUNT(MID) AS APP_NO
FROM ACT LEFT JOIN APP ON APP.VID=ACT.VID
GROUP BY ACT.VID)                                         ①

SELECT ACT.VID
FROM ACT, CNT
WHERE (ACT.VID = CNT.VID) AND (ACT.QUOTA > CNT.APP_NO)
```

Marks

(e) (i)
```
Ben Hung
Greg Chan
Rita Lam
```
2

① 2 matches for the first 3 rows

(ii) List the three most senior members. 1

(f) STATUS – defined as a logical data type (character) that indicates the status of the application (or RDATE – defined as a date data type that indicates the date of rejection) 1

REASON – defined as a character data type that stores the explanatory note for rejecting the application 1

2. (a)
```
SELECT PID FROM HUB1
INTERSECT
SELECT PID FROM HUB2
INTERSECT
SELECT PID FROM HUB3
```
2

① use of `INTERSECT`
① all correct

Alternative:
```
SELECT HUB1.PID
FROM HUB1, HUB2, HUB3
WHERE HUB1.PID = HUB2.PID AND HUB1.PID = HUB3.PID
```

(b) (i) `HH` becomes a view to show all records in the three tables. 1

(ii)
```
SELECT PID, MAX(HB), MIN(HB) FROM HH
GROUP BY PID
```
1
1

① 1st or 2nd line
① all correct

(iii) She creates a view for all users who do not have the access rights to execute `SELECT` command on the database tables. It can maintain the existing access rights to protect the database tables. / It materializes the query and increases the efficiency. 2*

(✕ only mentioning quick querying)

(c) (i) There are fewer chances of data inconsistency due to missing links. / direct retrieval (faster) 1

(ii) The design is supported by all kinds of DBMS. / The images are not stored in the DBMS and the DBMS performs better. 1

(d) Advantage: The data is well maintained/consistent. 1
Disadvantage: The database becomes slow in process. / It has a higher network security risk. 1
(✕ only mentioning 'poor security')

(e) Do not disclose the data to other unauthorised persons. 1×2
Use the data as their original purpose.

Marks

3. (a) (i) It requires more storage space. 1×2
It requires overheads on updating.
It may lead to data inconsistency.

(ii) It can increase query efficiency. / It is more convenient to access the data. 1

(b) `BCODE` and `BTYPE` (`FCODE` and `FTYPE`) 1+1
`BCODE` determines exactly one value of `BTYPE` .

(c) (i) There may be two records with the same `FCODE`. (not unique) 1

(ii) One order can only have one filing if `ONO` becomes the primary key. / `ONO` is not unique. 1

(d) (i) Primary key: `ONO` + `BCODE` + `FCODE` 1
Foreign key: *`BCODE, FCODE`* 1

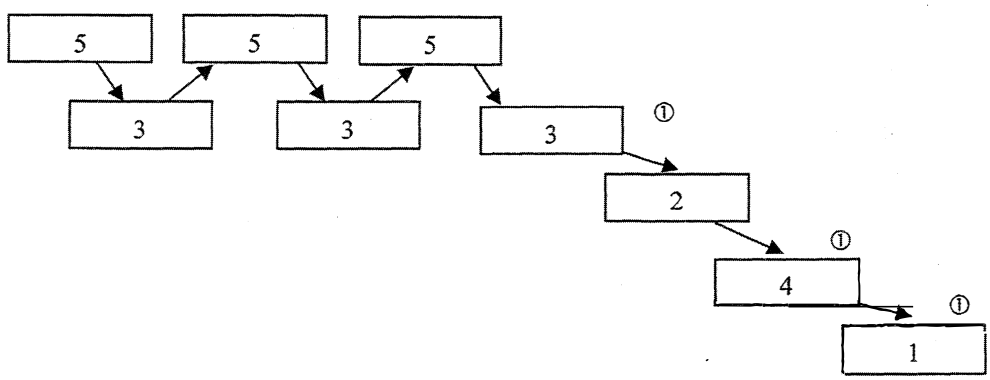
(ii) Yes, all tables have no transitive dependencies (all attributes totally depend on the primary keys) 1
and the design is in 2NF (no partial dependency on primary keys). 1

(e) ① choice of bread 3
① choice of fillings with additional cost
① reasonable layout & design

4. (a) database administrator, database designer, data entry operator, system analyst, programmer, database developer 1×2

(× database entry operator, server administrator)

(b) (i) 3

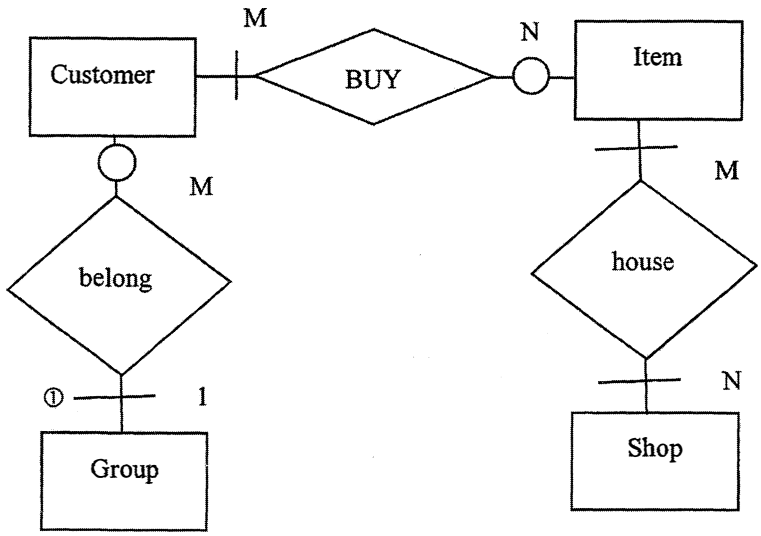


(ii) Risks/Errors are identified and resolved during the iteration. / 1
It costs less to change the scope/requirements.

(c) Graphical modeling tools: 3 1
Query analysis tools: 1, 4 1, 1

Marks

(d) 4



①,① entities
① M–1
①,① M–N

4 out of 5 marks

(e) (i) Preference – It is frequently used by users so that the query on the field can be executed faster. 1+1
(① Data field + ① a reasonable explanation)

(ii) Susan should look for the buying habit of customers and find the items that are popular to those belonging to the same buying habit group. (trends & patterns) 2*

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

Paper 2B

			Marks
1.	(a)	data transmission rate/bandwidth, transmission frequency, MIMO, number of channels. ✕ transmission distance, maximum number of users	1×2
	(b) (i)	Identify a wireless network from the others.	1
	(ii)	It avoids confusion with other wireless networks. / Travellers cannot identify the desired network. / Security issue – for example, using default SSID will let hacker try using default passwords to get access to the wireless network.	1
	(iii)	Travellers can shift the connection from one access point to another seamlessly when they move. / The connection is shifted from an access point with a weak signal to an access point with strong signal of the same SSID.	1
	(c) (i)	The airport does not need to distribute usernames and passwords. (simple operation) Less setup time is needed. (setup) Travellers can use the network immediately. (ease of use) The overall time (✕ rate, speed) for transmission can be shorter as no decryption time is needed	1×2
	(ii)	WEP has lower security. ✕ WEP is an outdated technology.	1
	(iii)	Data contents in Network 2 are encrypted. / They have different protocols. / It is faster to transmit data in Network 1 as no decryption is needed.	1
	(d) (i)	It is because collisions cannot be detected in the wireless environment.	1
	(ii)	Immediately after a node receives a packet, the CSMA/CA protocol ensures that the transmission channel is clear, i.e. no other node is transmitting at the moment.	1
		If the channel is clear, the packet will be sent. Otherwise, the node will need to wait for a random period of time for resending.	1
	(e)	Use SSID names different from that in the airport. Use WPA2 to avoid hacker attack. Require passwords for network connection to limit the access. Adjust channel to avoid interference. ✕ disclaimer	1×2

				Marks
2.	(a)	(i)	The data is not up-to-date. / There is a delay.	1
		(ii)	Processing power, network stability, network availability	1×2
	(b)	(i)	It is faster to set up the database server.	1
		(ii)	The backup may be destroyed with the database in a disaster (such as fire).	1
		(iii)	It could be magnetic tape / hard disk because it can provide larger storage capacity.	1+1
	(c)	(i)	Use a firewall with configured access control list to control inbound and outbound communication.	2*
		(ii)	Use RAID1 / RAID5 to allow recovery of data when a hard disk fails.	2*
		(iii)	Connect the NAS device with an uninterruptible power supply so as to provide the NAS sufficient power to shut down itself gracefully during power interruption.	2*
	(d)		Advantage: The workload due to protecting data loss is minimised. / It is easier to access the files outside.	1
			Disadvantage: The security control is lower. / More work on monitoring the network traffic may be necessary.	1
3.	(a)	(i)	210.0.205.237	1
		(ii)	Connect to an Intranet. (devices to the gateway)	1
	(b)	(i)	1 router: 1 G / 15M = 66 students 2 routers: 2× 66 = 132 students	2
		(ii)	There are overheads for the network connection. / Some students may use multiple devices.	1
		(iii)	Reasons regarding signal strength (coverage) / backup / redundancy / load balancing	1×2
	(c)	(i)	The student is not required to set up the network manually. (simple setup)	1
		(ii)	(1) different (2) same (3) same (4) same	1×4
		(iii)	The gateway refers to the networking device connecting to different subnets and the Internet (WAN). × simply mention router functions	1
	(d)	(i)	Two ethical practices from different categories (e.g. inappropriate language, gambling and hacking)	1×2
		(ii)	Two guidelines from different scopes (e.g. User acknowledgement, security of your mobile device and risks/liabilities of the use)	1×2

			Marks
4.	(a)	Advantages: There is more access control. (security) It has better data traffic management.	1×2
		Disadvantages: The hardware cost is higher. The network management work is more complicated.	1×2
	(b) (i)	No, it is because there are at most 127 IP addresses in each subnet, which is not suitable for the students' subnet.	1 1
	(ii)	Paul can use 192.0.1.1 and 192.0.2.1 to set up the communications between the two subnets such that they can send and receive data through the gateways. (trust rule)	2*
	(c) (i)	The web server is out of order. The reply is blocked by a firewall or by a NAT device. The DNS is out of order. There is network congestion. There are packet filtering routing errors.	1×2
	(ii)	Use other ports (web browsing) Use other utilities (e.g. tracert)	1 1
	(d)	Agree. PING can be used to access web servers. Hackers could control infected computers to issue a tremendous number of accesses to a web server by using PING, leading to a denial-of-service (DoS) attack.	2*

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

Paper 2C

Marks

1. (a) (i) More useful features (functions) are supported (improved), e.g. built-in canvas. / 1
More bugs are fixed. /
Some new standards can be followed.

× It is easier to use.
× Plug-in may not be required.

(ii) Old browsers do not support it (compatibility). 1

× Training is required.

(b) (i) The compression ratio is larger. (smaller file size) / 1
No extra plugin is required. (support)

× Suitable for iOS or Android platform, streaming, better quality, more stable, cross-platform

(ii) More system resources are needed when editing MP4 files. 1

(iii) avi, ogg/ogv (Theora), WebM (VP8, VP9), flv (VP6), asf, mov/qt/qtff (QuickTime) 1×2

× mpg, H.264, Flash, swf, mpeg-1

(c) (i) The font type is not installed in their computers. 1

(ii) Write a CSS to access the special font online. 1×2
Use graphics to represent the text.
Notify users to download the special font.

(d) (i) 20 x 30 x 1920 x 1080 x 10 / 8 bytes 2
= 1483 MB (or 1480 to 1555 MB)

① the expression showing the correct concept
① within range

(ii) Frame rate → not smooth × slow or poor 3
Frame size → not clear × smaller
Colour depth → less colourful × poor
Aspect ratio → stretched / cut off

(iii) Use streaming technology. / Increase the bandwidth. 1

× Split the video file into small files for download.
× Download a zipped video file.
× Change the video setting. / Reduce the resolution. / Increase the compression ratio.

				Marks
2.	(a)	(i)	There is much hotel information and the storage size is very large. It had better not to download all to the client side. / Obtain the most updated information. Only necessary information is downloaded from the server side/database.	1 1
		(ii)	It is sufficient to generate '14/5/2016' in the client side and it is not necessary to send it back to the server for computation.	1
		(iii)	calendar / pull-down menu ✗ text columns	1
	(b)	(i)	It helps users verify their input data.	1
		(ii)	Non-positive integers are not allowed in the 'Length of stay'. Others: Check-in >= Today Check-out > Check-in Presence check: Destination, Adult, Children (Check-in, Length of stay, Check-out ✗) Type check (whole number, non-negative number): Length of stay,, Adult, Children Format check (Date, Month, Year): Check-in, Check-out	2*
	(c)	(i)	Select a few requirements such as bed size and room size.	1
		(ii)	Reduce the number of hotels by a price/star range.	1
		(iii)	Select either smoking or non-smoking (one item only).	1
		(iv)	Sort the number of stars and then the price.	1
	(d)	(i)	Zoom in/out, navigation, 3D map, aerial map, street view Show current user position, route plan, Show nearby transport/buildings Print map	1×3
		(ii)	Use external map service (e.g. Google map)	1

Marks

3. (a) The text is too long. / The font is too small. (Display) 1×3

The layout changes in smaller screens. / Aspect ratios of screens are different. /
Remove frameset. (Layout)

The resolution of images is unnecessary high and hence the downloading time is long. /
Compress image/audio, decrease bit rate, remove unnecessary multimedia (e.g. background music) (Attribute of multimedia)

The file size should be small for mobile network. (File size)

The hyperlinks embedded in the text are too small for using a touch screen to click. /
The menu is too complicated for a small screen. (Navigation)

Some multimedia elements (e.g. Flash) may not be viewable in some mobile devices. (Plug-in)

✗ Terms without description (font size, image size, layout)
✗ Create the text version
✗ It suits all smartphone OS / Compatibility / Cross-platform
✗ It should work in mobile phone/wireless network / Network transmission speed
✗ Reduce cost / Content of website
✗ Server loading should be sufficient to handle a lot of users
✗ File size of website / Text coding system / browser version
✗ User can adjust text size

(b) row span, alignment, padding, 1×3
border width/border, background colour
rowspan, border, bordercolor, cellpadding, bgcolor, rowspan and align. (Accept attribute names)

✗ merge cell, colspan, table width, width, height, column header(<th>)

(c) (i) AcQ 3
Matching ①
with options (e.g. Drag-n-drop, Draw line, Menu/List, MC (a limited number of options))
✗ Fill-in-the-blank

Navigation with relevant content & description ①
User can navigate between acronym/full names (e.g. scrollbar & next button)

Score/feedback with relevant content (result) ①
(e.g. score, message & removal of correct items)

(ii) AcG 3
Game for two players with relevant content ①
e.g. split the screen into two, show information (e.g. score/progress/question) of the other player

Description of strategy with relevant content (e.g. take turn) ①
Describe how two players to interact/play with each other

Win/loss with relevant content ①
How to decide a win/loss

Marks

(d) It detects the locations of users and then displays an appropriate, default language for users to choose. / Find the other player nearby. / Find the distribution of users for marketing. 1

✗ Collect user locations / city / country to allocate the network bandwidth evenly.

Marks

4. (a) It achieves better image compression. (smaller file size) 1×2
It supports greater colour depth (up to 64-bit).
It supports interlacing.
It is a lossless image compression format.
It is non-patented.
It supports transparency/ a transparent background.
It supports animation.

(b) Animated GIF, HTML5, Flash, JavaScript, <BLINK> 1×2

(c) (i) $\underbrace{(44.1\times1000\times16\times2\times60)}_{①}\div8\div1024\div1024\approx10.1$ MB (acceptable range: 10.0 – 10.6) 2

(ii) Sampling rate: 22 kHz (≥ 8 kHz) 2
Sample size: 8 bits (≥ 4 bits)
Number of channels: 1 (≥ 1)

Note: The figures should be reasonable.
3 values are changed and the file size is reduced ②
1 or 2 values are decreased and the rest is left blank ①

(d) (i) The hyperlink is wrong. (wrong path) 1×2
The image file does not exist. (no upload)
The file format of the image is not supported by the browser.

(ii) The browsers used are different and they interpret CSS codes differently. 2*

① different browsers

(iii) The character set of the web page / keywords of the web page for search engines / description of the web page / title / author / copyright / creation date / character encoding / refresh web page / re-direction 1×2

(e) ① ALL 4 scripts are needed (onClick; when ... clicked; if ... clicked) 3
① manipulating N, i.e. N←N+1, N←N-1, assignment of variable is shown
① toggle images / swap images / hide and show / change object / replace

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

Paper 2D

Mark

1. (a) (i) (3) Requirements
(2) Design
(4) Implementation
(1) Integration — 4

(ii) (2) Design — 1

(iii) (4) Implementation — 1

(iv) RAD requires sufficient resources to create the right number of RAD teams. (highly skilled developers) /
If the system cannot be properly modularised, building components for RAD will be problematic. /
It requires user involvement during implementation. /
It has low program re-usability. / — 1

× unclear requirements / unable to go back for bug fixes / no user acceptance test

(b) A linker takes pre-compiled object files or libraries of subroutines (system functions) in and links them with the compiled main program into a single executable file. — 1, 1

Loader is a utility program that loads an executable file into memory. The loader is usually a part of the operating system and it is loaded when the computer is booted and resides in memory. — 1, 1

× loading programs to memory

(c)
```
-1
-1
 3
-1
```
1×4

2. (a) (i) Queue — 1

(ii) `Start = [5] , Next = [3]` — 1,1

0	1	2	3	4	5	6	7
Ken	Joan	Lily			Belle	Joe	June

1

(b) `next`
remainder of `((next+1)/n)` (`mod` or `%` is acceptable)
`start`
remainder of `((start+n-1)/n)` (`mod` or `%` is acceptable) — 1×4

(c) `next-start` — 1

`next + n - start`
or
`n - (start - next)` — 2

① for using `n=8`

Marks

(d)
```
total ← 0
i ← start
while i <> next do
    if S[i] = 2
        then total ← total + 1
    i ← remainder of (i+1)/n)
display total
```

Initialize `total` to 0	①
If `S[i]=2` then	①
increase `total`	①
Display `total`	①
All correct	①

5

Alternative:
```
total ← 0
If next >= start
   then
     for i from start to (next-1)
        if S[i] = 2
            then total ← total + 1
   else
     for i from start to (n-1)
        if S[i] = 2
            then total ← total + 1
     for i from 0 to (next-1)
        if S[i] = 2
            then total ← total + 1
display total
```

3. (a) (i) 1, 3, 4, 11, 20 (1 error ①) 2

(ii) 1

1	2	5	6
3	4	7	8
9	10	13	14
11	12	15	16

(iii) 1

1	2	5	6
3	4	7	8
9	10	13	14
11	12	15	16

- 4 cells are grouped into an island
- each island can rotate in 4 positions

(b)
```
for i from 1 to 16
   P[i] ← 'W'
for i from 1 to N
   if A[i] <= 16 then
         P[A[i]] ← 'B'
   else
        k ← (A[I] - 17) × 4
        for j from 1 to 4
            P[k+j] ← 'B'
```

Initialize `P[]` to `'W'`	①
Loop `N` times	①
If `A[i]` in `[1..16]` then	①
`P[A[i]]` ← `'B'`	①
If `A[i]` in `[17..20]` then fill four `'B'`s correctly	①

5

Marks

(c) (i) 2, 11, 17, 20 (1 error ①) 2

(ii) 1

1	2	5	6
3	4	7	8
9	10	13	14
11	12	15	16

(d) (i) 2

1	2	5	6
3	4	7	8
9	10	13	14
11	12	15	16

No 3 `'B'`s in an island	①
all correct	①

(ii) 1

1	2	5	6
3	4	7	8
9	10	13	14
11	12	15	16

same as 3(a)(iii)

4. (a) (i) Ensure that the Disc is put in a column from 1 to 7. / 1
Validate the input. / Avoid from an invalid input. /
Ensure that `col` is in a valid range.
✕ Ensure `col` is between 1 and 7.

(ii) Ensure that column `col` still has space for an additional disc. / 1
Check if the column is full or not.

(iii) Request the player to input the column number again. 1

(b) `col` 1
`col i` 1, 1
`4` 1

Marks

(c) Method 1 (Check both sides separately) 7

Check row on the left

① condition (iterating from `col-3` to `col`)

① structure (use of `BD` and correct row number)

Check row on the right

① condition (iterating from `col` to `col+3`)

① structure (use of `BD` and correct row number.)

① Use a variable to record the number of connected discs in a row

① Consider `(connected >= 4)` (Depending on the algorithm, some may need to check `connected >= 4`, `connected >= 3`.)

① Return a proper value (return true/false)

Method 2 (Check both sides together)

for i=1 to 7 (or 4, which is actually sufficient) in the row `topC[col]-1`

① iterating from 1 to 7

① correctly checking the connected player discs

② correctly using the `BD` structure

① using a variable to record the number of connected discs in a row

① correctly checking the condition of connected discs (e.g. >= 4)

① Return a proper value (return true/false)

```
r = topC[col]-1;
for(i = 1; i <= 4; i++)
if(BD[i,r] == player && BD[i+1,r] == player
&& BD[i+2,r] == player && BD[i+3,r] == player)
    return true;
```

Other Methods

① considering all possible columns

① checking the connected player discs

② correctly using the BD structure

① using a variable to record the number of connected discs in a row

① correctly checking the condition of connected discs (e.g. >= 4)

① Return a proper value (return true/false)

[Pascal version]

```
function checkRow(col:integer; player : char) : boolean;
var X, Y, i,  connected : integer;
begin
   { init }
   connected := 1;
   X := col;
   Y := topC[col] - 1;
   {check row on the left}
   i := X - 1;
   while (i>=1) and (BD[i, Y] = player) do begin
      connected := connected + 1;
      i := i - 1;
   end;
   {check row on the right}
   i := X + 1;
   while (i<=BOARDSIZE) and (BD[i, Y] = player) do begin
      connected := connected + 1;
      i := i + 1;
   end;
   checkRow := connected >= 4;
end;
```

[C version]

```
int checkRow(int col, char player) {
    int Y, i, connected;
    connected = 1;
    Y = topC[col]-1;
    i = col - 1;
    while (i>=1 && BD[i][Y] == player) {
         connected++;
         i--;
    }
    i = col + 1;
    while (i<=7 && BD[i][Y] == player) {
         connected++;
         i++;
    }
    return (connected >=4);
}
```

[JAVA version]

```
boolean checkRow(int col, char player) {
    int X,Y, i, connected;
    connected = 1;
    X = col;
    Y = topC[col]-1;
    i = X - 1;
    while (i>=1 && BD[i][Y] == player) {
         connected++;
         i--;
    }
    i = X + 1;
    while (i<=7 && BD[i][Y] == player) {
         connected++;
         i++;
    }
    return (connected >=4);
}
```

[Visual Basic version]

```
Function checkRow(col As Integer, player As Char) As Boolean
       Dim win As Boolean
       Dim X, Y, i, connected As Integer
       connected = 1
       X = col
       Y = topC(col) - 1
       i = X - 1
       While ((i >= 1) And (BD(i, Y) = player))
          connected = connected + 1
          i = i - 1
       End While
       i = X + 1
       While ((i <= BOARDSIZE) And (BD(i, Y) = player))
          connected = connected + 1
          i = i + 1
       End While
       checkRow = (connected >= 4)
End Function
```