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PAPER 1
(SECT A)

MC

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

PRACTICE PAPER
INFORMATION AND COMMUNICATION TECHNOLOGY
PAPER 1 (SECTION A)

(2 hours for both Sections A and B)

INSTRUCTIONS

1. Read carefully the instructions on the Answer Sheet. After the announcement of the start of the examination, you should first stick a barcode label and insert the information required in the spaces provided. No extra time will be given for sticking on the barcode label after the 'Time is up' announcement.

2. When told to open this book, you should check that all the questions are there. Look for the words '**END OF PAPER**' after the last question.

3. All questions carry equal marks.

4. **ANSWER ALL QUESTIONS**. You are advised to use an HB pencil to mark all the answers on the Answer Sheet, so that wrong marks can be completely erased with a clean rubber. You must mark the answers clearly; otherwise you will lose marks if the answers cannot be captured.

5. You should mark only **ONE** answer for each question. If you mark more than one answer, you will receive **NO MARKS** for that question.

6. No marks will be deducted for wrong answers.

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Not to be taken away before the end of the examination session

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There are 40 questions in this paper. Choose the most suitable answer.

1. After editing a document file, Jenny sends it to Peter for further editing. They use different word processors. In order to keep the document format the same, which of the following file formats should Jenny use?

   A. TXT
   B. PDF
   C. RTF
   D. TIF

2. Mary wants to convert an audio file, abc.wav, to mp3 format. What should she do?

   A. Use audio editing software to export the file in mp3 format.
   B. Rename the file as abc.mp3.
   C. Open the file with audio recognition software and save it as another file, abc.mp3.
   D. Copy the file to an mp3 player.

3. A colour photo is scanned using a scanner with 24-bit colours instead of 8-bit colours. This means that, in the chosen scanner,

   (1) the resolution is higher.
   (2) the file size is larger.
   (3) more different colours can be scanned.

   A. (1) and (2) only
   B. (1) and (3) only
   C. (2) and (3) only
   D. (1), (2) and (3)

4. A machine adopts two's complement for the representation of 4-bit integer. Which of the following calculations is more likely to have an overflow error?

   A. 3 + 3 + 2 – 4
   B. 2 – 4 + 3 + 3
   C. 3 + 3 – 4 + 2
   D. – 4 – 2 – 2

5. Which of the following statements about character representation is/are correct?

   (1) GB code supports both traditional and simplified Chinese characters.
   (2) Unicode represents more characters than GB code does.
   (3) The concept of ASCII is no longer applicable because of the use of Unicode.

   A. (1) only
   B. (2) only
   C. (3) only
   D. (2) and (3) only

6. Peter wants to extract records with a data item within a range of values from a database. Which of the following SQL operators should he use?

   A. LIKE
   B. IN
   C. DISTINCT
   D. BETWEEN

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Answer Questions 7 and 8 with reference to the following spreadsheet.

	A	B	C	D	E
1	Full name	Last name	First name	Date of birth	Age
2	CHAN TAI MAN	CHAN	TAI MAN	14/03/1980	31.0
3	CHEUNG MEI LAI	CHEUNG	MEI LAI	20/06/1978	32.7
4	SO SIU MING	SO	SIU MING	15/12/1985	25.5

7. Which of the following formulae is used in C2?

A. =A2-B2
B. =LEFT(A2, LEN(A2)-LEN(B2)-1)
C. =MID(A2, LEN(A2)-LEN(B2)+1, 1)
D. =RIGHT(A2, LEN(A2)-LEN(B2)-1)

8. Which of the following formulae can be used to calculate the approximate age in E2?

A. =NOW(1980,3,14)
B. =NOW(1980,3,14)/365
C. =(NOW()-D2)/365
D. =DATE(1980,3,14)-NOW()

9. Some sales records are stored in spreadsheet software, as shown below:

Product	Month	Quantity
DVD	2	5
Mobile Phone	2	4
DVD	1	23
DVD	2	13
⋮	⋮	⋮
TV	3	8

A pivot table is generated based on the sales records, as shown below:

Sum of Quantity	Product			
Month	DVD	Mobile Phone	TV	Grand Total
1	43	18	5	66
2	18	20	6	44
3	15	18	9	42
Grand Total	76	56	20	152

What are the settings of the fields?

	Row Field	Column Field
A.	Month	Product
B.	Product, Month	Quantity
C.	Quantity	Product, Month
D.	Product	Month

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10. Ms Lee wants to find students in Class `1A` from a list of all students stored in a spreadsheet.

Class	Name
1A	CHAN TAI MAN
2C	CHEUNG MEI LAI
1A	SO SIU MING
3B	LI KA MAN
4D	YIP HIU YEE
1A	WONG HO YIN
⋮	⋮

⇨

Class	Name
1A	CHAN TAI MAN
1A	SO SIU MING
1A	WONG HO YIN
⋮	⋮

Which of the following functions should she use?

A. Copy and paste
B. Delete
C. Filter
D. Find

11. Peter wants to replace the short form, 'LAN', with the full name, 'Local Area Network' in a document, as shown below.

Before: "The High Land School wants to build a LAN to ..."

After: "The High Land School wants to build a Local Area Network to ..."

Which of the following search options in the REPLACE function of a word processor should Peter choose?

(1) Use wildcards
(2) Find whole word only
(3) Match case
(4) Sounds like

A. (2) and (3) only
B. (2) and (4) only
C. (1), (2) and (4) only
D. (1), (3) and (4) only

12. Which of the following are common ways of showing record information in a database report?

(1) Records in a particular order
(2) Records that meet certain criteria
(3) Records with a table of contents
(4) Summary information of records

A. (2) and (3) only
B. (1) and (3) only
C. (1) and (4) only
D. (1), (2) and (4) only

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13. Which of the following attributes of an object will be saved when using Object Linking and Embedding with a document?

	Object Linking	Object Embedding
A.	Path of the object	Path of the object
B.	Object content	Path of the object
C.	Path of the object	Object content
D.	Object content	Object content

14. In which of the following hardware components can files be accessed in direct access mode?

(1) Flash memory card
(2) DVD-RW
(3) Hard disk
(4) Magnetic tape

A. (1) and (3) only
B. (2) and (4) only
C. (3) and (4) only
D. (1), (2) and (3) only

15. A device is installed in a vehicle to record the traffic using a camera. Which file format and storage medium are appropriate for the device?

	File format	Storage medium
A.	AVI	DVD-RW
B.	AVI	Flash memory card
C.	WMA	DVD-RW
D.	WMA	Flash memory card

16. Which of the following programs is used to improve the access time of files in a hard disk?

A. Virus checker
B. Defragmentation program
C. Backup program
D. File encryption program

17. In a commercial building, the security system will activate the alarm if one of the main doors is opened between 12 a.m. and 6 a.m. What kind of system is this?

A. Batch processing system
B. Real-time system
C. On-line interactive system
D. Multi-user system

18. Which of the following data will be stored in the program counter in a machine cycle?

A. Memory address
B. Memory data
C. Instruction
D. Number of instructions

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19. Which of the following are the main functions of a CPU?

(1) Performing arithmetic and logical operations.
(2) Storing system data permanently.
(3) Executing instructions of computer programs.
(4) Providing an interface between user and system.

A. (1) and (3) only
B. (2) and (3) only
C. (2) and (4) only
D. (1), (3) and (4) only

20. Which of the following statements about registers in a CPU is/are correct?

(1) They are 8 bits long.
(2) Cache memory is a kind of register.
(3) Accumulator is a kind of register.

A. (1) only
B. (1) and (2) only
C. (3) only
D. (2) and (3) only

21. If the Government establishes an '*Anti-drugs Authority*' in Hong Kong, which of the following domain names would be appropriate for it?

A. ada.com.hk
B. ADA.idv
C. ADA.edu.hk
D. ada.gov.hk

22. A company establishes a WAN instead of a LAN mainly because of the _____ .

A. cost
B. coverage
C. data transmission rate
D. number of users supported

23. When browsing a simple web page over the Internet, how will the content of the web page normally be transmitted?

A. The content will be divided into several packets that are probably sent through a single physical path.
B. The content will be divided into several packets that are probably sent through different physical paths.
C. The content will be encrypted and sent through a single physical path.
D. The content will be encrypted and sent through different physical paths.

24. A company subscribes for a 10M leased line instead of a 10M broadband connection because _____ .

A. the maximum data transfer rate is higher
B. it is cheaper
C. it is more secure
D. it is for commercial use only

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25. Which of the following statements about the use of video streaming technology is/are correct?

(1) The data transfer rate can be increased.
(2) The video can be watched before the file is completely downloaded.
(3) The video quality can be enhanced.

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

26. Which of the following statements about constructing traditional frames in a web page is/are correct?

(1) More than one HTML file is needed.
(2) A table with more than one column or row is needed.
(3) More than one background colour is needed.

A. (1) only
B. (1) and (2) only
C. (2) and (3) only
D. (3) only

27. Tom wants to upgrade the bandwidth of a school network from 100 Mbps to 10 Gbps. Which of the following upgrade plans do you suggest?

	Current	Suggested upgrade
A.	Internal network interface card	USB network interface card
B.	wired connection	wireless connection
C.	CAT 5 cable	Optical fibre
D.	switch	hub

28. A research company estimates that in 2012 China has over 500 million Internet users. China's Internet population becomes the largest in the world. Which of the following statements about China is/are correct?

(1) The growth in e-commerce will be greatly accelerated.
(2) The number of computers per person is the largest in the world.
(3) The broadband quality is the best in the world.

A. (1) only
B. (1) and (3) only
C. (2) and (3) only
D. (2) only

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29. `P` and `Q` represent `A ≥ 18` and `A ≤ 60` respectively. For which of the following values of Boolean expression, `NOT(P AND Q)`, be true?

(1) `0`
(2) `18`
(3) `30`
(4) `80`

A. (3) only
B. (2) and (3) only
C. (1) and (4) only
D. (1), (2) and (4) only

30. What kind of information is stated in the user manual of a software package?

A. Algorithm design
B. Algorithm testing
C. Source codes
D. System requirements

31. Which of the following sequences of tasks in problem solving procedures is correct?

(1) Outline the input and output requirements of the problem.
(2) Define the scope of the problem.
(3) Evaluate the output of the solution to the problem.
(4) Complete the testing and debugging.

A. (1) → (2) → (3) → (4)
B. (1) → (2) → (4) → (3)
C. (2) → (1) → (3) → (4)
D. (2) → (1) → (4) → (3)

32. What is the final value of `A` in the following pseudo codes?

```
A ← 5
B ← 10
IF (2×A) > 8
THEN IF A > (5+B)
     THEN  A ← B
     ELSE  B ← A
ELSE A ← A + 8
```

A. 5
B. 8
C. 10
D. 13

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33. Consider the following pseudo codes.

```
S ← 1
INPUT A
WHILE (S < 10)
      S ← S + A
```

Which kind of input values will prevent the occurrence of an infinite loop?

A. Any integer
B. Negative number
C. Zero
D. Positive number

34. A web site adopts an encryption key 2048 bits long instead of 1024 bits long. Why does this increase the security level?

A. Hackers take more time to crack the system.
B. The time for data transmission increases.
C. It is more difficult to memorise the key.
D. The size of an encrypted data packet increases.

35. Which of the following examples can effectively reduce theft of digital intellectual property?

(1) Use of digital watermarks
(2) Setting up firewalls
(3) Updating virus definition files frequently

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

36. In the following HTML code, what are the six digits after '#'?

```
<BODY BGCOLOR="#112233">
```

(1) They represent three values for the colours red, green and blue.
(2) They are used to transfer to DNS for web browsing.
(3) They refer to three hexadecimal values.

A. (1) only
B. (2) only
C. (1) and (3) only
D. (2) and (3) only

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37. Mrs Lee does not allow her son to use Bit Torrent freeware on her home computer because

(1) her son may download illegal software.
(2) it is illegal to use the software.
(3) his school does not install this software.

A. (1) only
B. (1) and (2) only
C. (1) and (3) only
D. (2) and (3) only

38. Which of the following equipment can help to minimise repetitive strain injury to fingers and wrists during typing?

A. A footrest
B. An armrest
C. A large screen
D. A large desk

39. The disconnected security token illustrated below is commonly used for online authentication. Which of the following statements about such authentication is correct?

A. No username and password are needed.
B. The six-digit number changes regularly.
C. Once the button is pressed, a six-digit number is imported from a server to the token.
D. Digits are used because they can be converted into ASCII code.

40. Computer Assisted Diagnosis (CADx) helps doctors interpret medical images of the human body. It combines the elements of artificial intelligence and digital image processing. Which of the following domains of knowledge is the most important to CADx?

A. Office automation software
B. Web authoring
C. Algorithm design
D. Machine organisation

END OF PAPER

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PAPER 1
(SECT B)

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Candidate Number									

PRACTICE PAPER
INFORMATION AND COMMUNICATION TECHNOLOGY
PAPER 1 (SECTION B)
Question-Answer Book

(2 hours for both Sections A and B)
This paper must be answered in English

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3 and 5.

(2) **ANSWER ALL QUESTIONS.** Write your answers in the spaces provided in this Question-Answer book. Do not write in the margins. Answers written in the margins will not be marked.

(3) Supplementary answer sheets will be supplied on request. Write your Candidate Number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this book.

(4) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

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Answer all questions.

1. Mr Wong is responsible for setting up an inventory system in a supermarket. He creates a database table INVENTORY, to store the information on products for sale. Part of INVENTORY is shown below:

INVENTORY

CAT (Category)	CODE (Product code)	NAME (Product Name)	PRICE (Price of product)	QTY (Number of items in stock)
Beverage	B163	BEST juice	10.0	10
Snack	S968	좋은감자칩	12.2	40
Noodle	N042	乐乐浓汤鸡面	20.2	20
Beverage	B482	FRESH tea	25.9	80
Noodle	N091	QQ noodle	8.4	50

(a) Which field, CAT, CODE, NAME, PRICE or QTY, should be used as a key field? _____

(1 mark)

(b) The data type of QTY is integer. Judy, Mr Wong's colleague, suggests changing it to real number or string. Mr Wong disagrees with Judy's suggestion. Why?

(2 marks)

(c) For storing data under NAME, which character encoding system is most suitable? Explain briefly.

(2 marks)

(d) (i) Mr Wong writes the following SQL command. Based on the five given records in INVENTORY above, what is the query result?

```
Select CODE, PRICE from INVENTORY where PRICE > 10 and QTY < 40
```

(ii) INVENTORY is imported into a spreadsheet file. Describe, with steps, how to use the functions of spreadsheet software to extract the same data as the query result in (d)(i).

(4 marks)

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Please stick the bar here.

(e) Mr Wong considers replacing the existing barcode system with a Radio Frequency Identification (RFID) system, to capture product information. State one advantage and one disadvantage of using the RFID system over the barcode system.

Advantage: _____

_____

Disadvantage: _____

_____

(2 marks)

2. Susan buys a tablet PC for her work. The specifications of the PC are shown below.

CPU	1.2 GHz dual-core processor
Display unit	8-inch LED touch screen
Memory and storage	512 MB (ROM), 64 GB flash memory
Input / Output	USB 2.0, Built-in speaker
Connectivity	Wi-Fi, Bluetooth
Battery (life time)	14 hours
Weight	0.5 kg
Dimension	190×130×10 mm

(a) State **two** features of the tablet PC that are mainly designed for mobility.

_____

_____

(2 marks)

(b) (i) The tablet PC has 64 GB flash memory installed, which is quite different from an ordinary notebook computer. Why?

_____

_____

(ii) Should SDRAM replace the flash memory in the tablet PC? Explain briefly.

_____

_____

_____

(3 marks)

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Answers written in the margins will not be marked.

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(c) What is the most important program stored in the ROM of the tablet PC?

(1 mark)

Susan finds that her desktop computer at work is infected with a computer virus.

(d) (i) State **two** possible ways that the computer virus can be spread to other computers through the Internet.

(ii) Sometimes even state-of-the-art antivirus software cannot remove some computer viruses. Explain briefly why this is the case.

(3 marks)

Susan suggests that Patrick, a technician in the company, install photo editing shareware with a 30-day trial period on the office computers.

(e) (i) Before the installation, what copyright issue should Patrick know about? What document should he read?

(ii) Susan downloads and installs a pirated copy of photo editing software on her computer. What is the possible legal consequence of her action?

(3 marks)

(f) Patrick installs a software package on all computers such that the system in each computer will be automatically restored to its original state on every reboot. Give one advantage and one disadvantage of this software package.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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Please stick the bar here.

3. Mr Law develops a computer system with the help of Ada and Ben. The system is used to find the equivalent grade for an input mark.

(a) Ada uses the following pseudocode to represent her algorithm.

```
Step 1: Input a value into MARK
Step 2: If MARK < 40 Then GRADE ← 'Unattained'
Step 3: If MARK >= 40 Then GRADE ← 'Attained'
Step 4: If MARK >= 80 Then GRADE ← 'Distinction'
Step 5: Output GRADE
```

(i) What is the value of `GRADE` for each of the following values of `MARK`?

(1) `MARK = 40` `GRADE =` _____

(2) `MARK = 200` `GRADE =` _____

(ii) Ada modifies the pseudocode by applying iteration control structure in Step 1 so that the value of `MARK` is between 0 and 100 inclusive as shown below.

Step 1: Repeat the input of values into `MARK` when the value of `MARK` is smaller than 0 or larger than 100

(1) Other than 0 and 100, give another test datum that can be used to identify the boundary cases of the algorithm.

_____

(2) Which type of iteration control structure, pre-test, post-test or for loop, is used by Ada?

_____

(4 marks)

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Answers written in the margins will not be marked.

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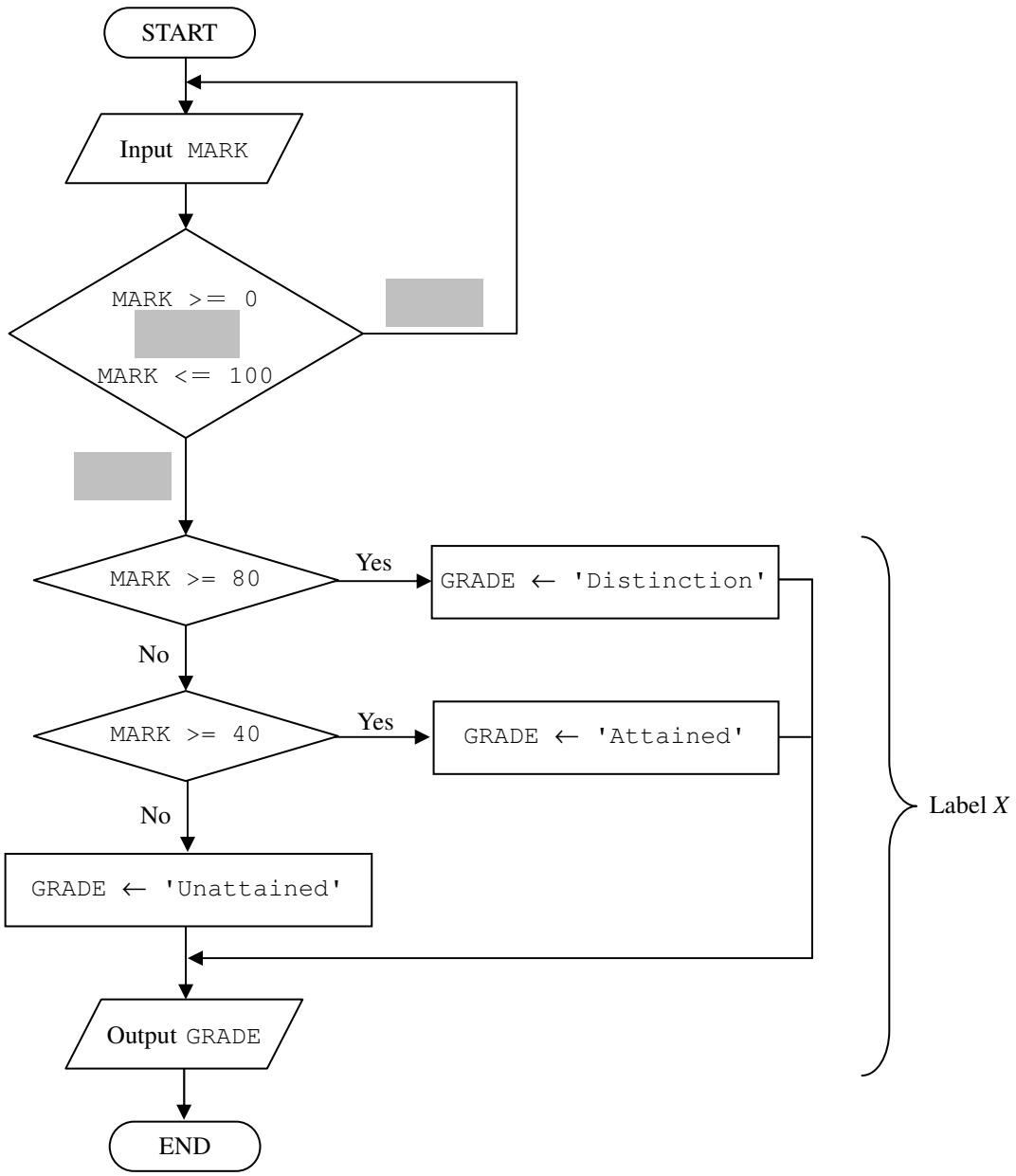
(b) Ben uses the following flowchart to represent his algorithm. Write down `YES`, `NO` and an app operator in the shaded areas for the first decision box.



(2 marks)

(c) Compare the algorithm indicated by Label *X* with Ada's algorithm. Which one is more efficient? Explain briefly.

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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(d) A workstation in the system provides a virtual keyboard on the screen which can be used to [illegible] marks.

(i) Give one advantage and one disadvantage of this design.

Advantage: _____

_____

Disadvantage: _____

_____

(ii) Suggest a common way to connect a keyboard to the workstation other than using a USB port.

_____

(iii) Mr Law wants to connect a USB printer to the workstation but the connection fails. What is the potential software problem?

_____

_____

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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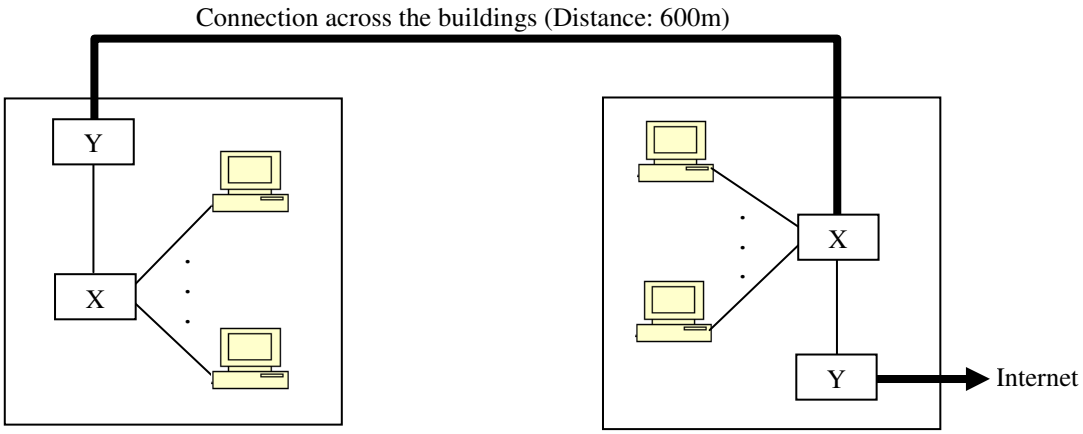
4. Mr Li is the IT manager of a university in Australia. On the campus there are two computer networks in Building A and Building B which are used by staff and students respectively. The two buildings are apart, as shown below.



(a) (i) What network connecting devices are X and Y?

X: _____ Y: _____

(ii) Suggest a suitable type of network cable for the connection across the buildings and justify your answer.

_____

_____

(iii) Instead of using a wired connection, Mr Li wants to connect two networks by installing microwave dishes on the roofs of the buildings. State **two** disadvantages of this approach.

_____

_____

_____

(5 marks)

(b) Mr Li subscribes to an Internet connection. A cable modem is needed to connect the campus network to the Internet. What is the function of the cable modem?

_____

_____

_____

(2 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

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(c) Mr Li sets up an email server in the university and offers an email account to each student. In ea
following cases, which email protocol for accessing email boxes is preferable? Justify your answ

(i) Each email box only has 5 MB storage space.

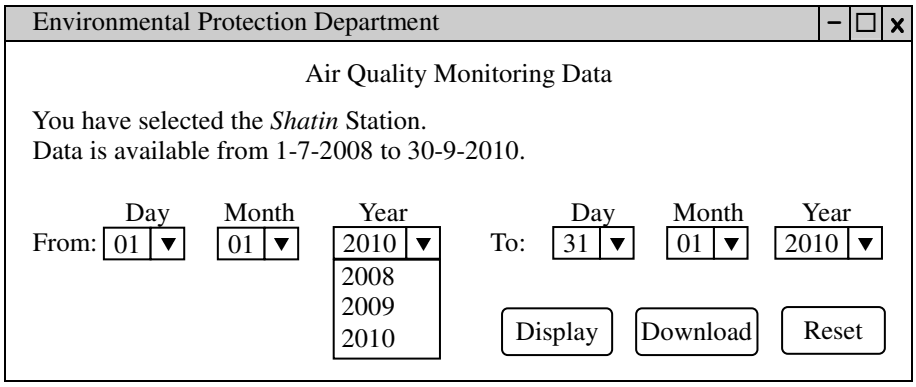
(ii) Students can access their email boxes through any computer with Internet access.

(4 marks)

Answers written in the margins will not be marked.

Answers written in the margins will not be marked.

5. Peter wants to study the air quality in Shatin and Kwun Tong. He downloads the air quality monitoring data from the website of the Environmental Protection Department, as shown below:



(a) (i) In the web page above, how can the use of drop-down lists help with data input?

(ii) There should be two validation rules for checking the input data. Give two different sets of **invalid** data to illustrate the need for the rules.

		Day	Month	Year		Day	Month	Year
Set 1	From:				To:			
Set 2	From:				To:			

(3 marks)

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The readings of air pollutants, P1, P2 and P3, are collected every 6 hours. Peter downloads the data [illegible] at Shatin and Kwun Tong in January 2010 and stores them in two worksheets of a spreadsheet file, [illegible] and *Sheet2*, respectively. *Sheet1* is shown below.

	A	B	C	D	E	F	G
1			**Time**				
2	**Date**	**Pollutant**	**00 00**	**06 00**	**12 00**	**18 00**	**Average**
3	1-1-2010	P1	14	12	11	9	
4	1-1-2010	P2	116	103	102	78	
5	1-1-2010	P3	28	20	21	29	
6	2-1-2010	P1	25	18	18	26	
7	2-1-2010	P2	87	90	86	63	
8	2-1-2010	P3	10	9	9	2	
9	3-1-2010	P1	86	83	83	7	
⋮	⋮	⋮	⋮	⋮	⋮	⋮	
94	31-1-2010	P2	37	15	7	82	
95	31-1-2010	P3	4	6	12	3	
96							
97						P1 average:	

(b) Peter wants to find the average reading of P1 at Shatin in January 2010.

(i) To find the daily average readings of the pollutants everyday, a formula is entered into `G3` and is then copied into `G4` to `G95`. Write the formula in `G3`.

(ii) Write the formula in `G97` to find the average reading of P1 at Shatin in January 2010.

(4 marks)

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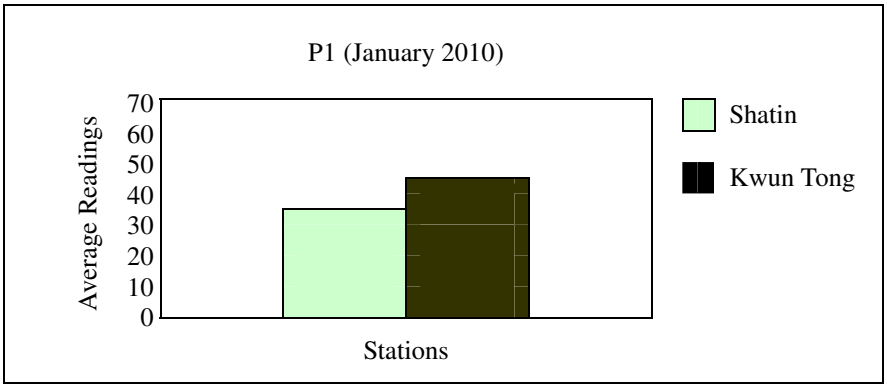
(c) The same steps in (b) have also been applied to *Sheet2* for the data collected at Kwun Tong.

Peter creates the following chart to show the average readings of P1 at Shatin and at Kwun Tong in January 2010.



(i) Describe, with major steps, how to create the chart.

(ii) Peter copies the chart into his presentation file. Afterwards he updates some readings of P1 on *Sheet1*. Will the chart in the presentation file change accordingly? Explain briefly.

(5 marks)

END OF PAPER

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Reserved Words and Functions

Database (SQL commands − based on SQL−92 Standard)

Constants	FALSE, TRUE
Operators	+, –, *, /, >, <, =, >=, <=, <>, %, _ , ' , AND, NOT, OR
SQL	ABSOLUTE (ABS), AVG, INT, MAX, MIN, SUM, COUNT ASC, AT, CHAR (CHR), CHAR_LENGTH (LEN), LOWER, TRIM, SPACE, SUBSTRING (SUBSTR/MID), UPPER, VALUE (VAL) DATE, DAY, MONTH, YEAR ADD, ALL, ALTER, ANY, AS, ASC, BETWEEN, BY, CREATE, DELETE, DESC, DISTINCT, DROP, EXISTS, FROM, GROUP, HAVING, IN, INDEX, INNER JOIN, INSERT, INTEGER, INTERSECT, INTO, LEFT [OUTER] JOIN, LIKE, MINUS, NULL, RIGHT [OUTER] JOIN, FULL [OUTER] JOIN, ON, ORDER, SELECT, SET, TABLE, TO, UNION, UNIQUE, UPDATE, VALUES, VIEW, WHERE

Electronic Spreadsheet

Constants	TRUE, FALSE
Operators	+, –, *, /, <, >, =, <>, <=, >=
Functions	ABS, INT, MOD, QUOTIENT, RAND, ROUND, ROUNDUP, ROUNDDOWN, SQRT, TRUNC, AND, NOT, OR CHAR, CODE, CONCATENATE, EXACT, ISBLANK, LEFT, LEN, LOWER, MID, PROPER, RIGHT, TEXT, TRIM, UPPER, VALUE AVERAGE, COUNT, COUNTA, COUNTBLANK, COUNTIF, LARGE, MAX, MIN, RANK, SMALL, SUM, SUMIF, SUMPRODUCT, SUMSQ, FREQUENCY DATE, NOW FIND, HLOOKUP, VLOOKUP, LOOKUP, SEARCH, CHOOSE IF

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PP-DSE
ICT
PAPER 2A

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PRACTICE PAPER
INFORMATION AND COMMUNICATION TECHNOLOGY
PAPER 2A
Databases
Question-Answer Book

(1 hour 30 minutes)
This paper must be answered in English

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3 and 5.

(2) **ANSWER ALL QUESTIONS.** Write your answers in the spaces provided in this Question-Answer book. Do not write in the margins. Answers written in the margins will not be marked.

(3) Supplementary answer sheets will be supplied on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this book.

(4) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

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Answer all questions.

1. An examination agent designs the following database tables to store the information on candidates w... register for examination.

CAND

Field name	Type	Width	Description
CNUM	Character	8	Unique candidate number of the candidate where the first three characters are the unique school code of the candidate's school
CNAME	Character	30	Name of the candidate
DOB	Date		Date of birth of the candidate

REGISTER

Field name	Type	Width	Description
CNUM	Character	8	Candidate number of the candidate who sits the examination of the subject
SCODE	Character	2	Unique subject code

SUBJECT

Field name	Type	Width	Description
SCODE	Character	2	Unique subject code
SNAME	Character	30	Name of the subject

(a) (i) Write a SQL command to create CAND.

(ii) Which of the following can be a candidate key of CAND? Explain briefly.

(1) CNUM (2) CNAME + DOB

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(iii) Write a SQL command to create an index file, CIND, for CAND on CNUM. What is the advantage of using this index file?

SQL command: _____

_____

Advantage: _____

_____

(7 marks)

(b) Identify the primary key(s) and foreign key(s) of REGISTER.

Primary key: _____

Foreign key: _____

(3 marks)

(c) (i) Write a SQL command to increase the width of CNUM in CAND to 12. Make sure that CNUM would never be empty.

(ii) Write a SQL command to list all the candidate names and their corresponding school codes.

(iii) The subject code and subject name of a new subject are 09 and LAW respectively. Write a SQL command to insert this record into SUBJECT.

(6 marks)

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2. A database table, CLINIC, stores the information on patients who visit a clinic for treatment. The design of CLINIC is based on the following assumptions:

- There may be some illnesses that no patient ever visits for.
- A doctor can prescribe medicine by zero or more injections for an illness and prescribe medicine by one injection for a number of illnesses.

The fields in CLINIC are shown below:

Field name	Description
PNUM	Unique patient number
PNAME	Name of patient
VDATE	Date of the clinic visit
ICODE	Unique illness code
INAME	Name of illness
MCODE	Unique injection code
MNAME	Name of the injection

(a) Explain briefly how the design of CLINIC leads to data redundancy.

_____

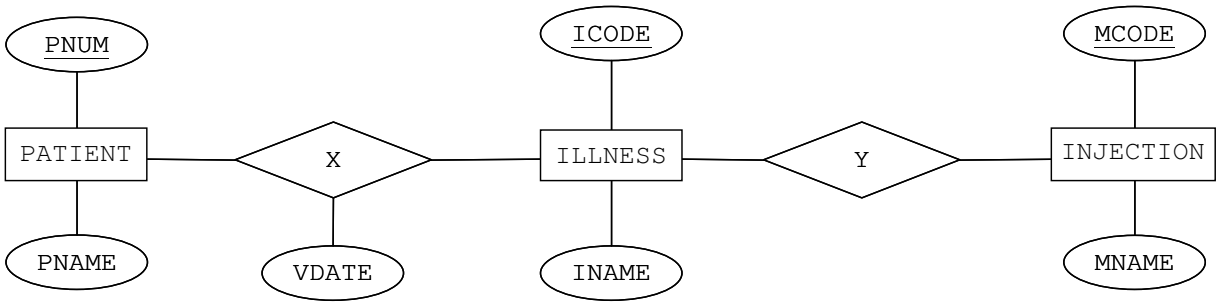
_____

_____

_____

(2 marks)

The incomplete E-R diagram below represents an alternative design for the clinic to fulfill the assumptions.



(b) (i) Give the appropriate words for the relationships in X and Y.

X: _____ Y: _____

(ii) Complete the E-R diagram above.

(5 marks)

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(c) Transform the E-R diagram into the database schemas below.

X ( )

Y ( )

(4 marks)

(d) Can the alternative design handle an illness without the need for an injection? Explain briefly.

(2 marks)

(e) One day, one type of medicine is prohibited by the government.

(i) Give one problem which will occur when the record of the prohibited medicine is removed from `INJECTION` in the alternative design.

(ii) Suggest a method of handling prohibited medicines in the alternative design.

(2 marks)

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3. A web site uses the following database tables to store information on restaurants.

RES

Field name	Type	Width	Description	Example of data
RESID	Character	5	Identification code of the restaurant	02173
RESNAME	Character	30	Name of the restaurant	EAA Cafe mini
RATING	Numeric	1	Rating of the restaurant	3
DISTRICT	Character	2	District code of the restaurant	04
CUISINE	Character	2	Cuisine code of the restaurant	07
SPENDING	Numeric	3	Spending per person	80

DIST

Field name	Type	Width	Description	Example of data
DISTRICT	Character	2	District code	04
DISTNAME	Character	30	Name of the district	Wanchai

CUI

Field name	Type	Width	Description	Example of data
CUISINE	Character	2	Cuisine code	07
CUINAME	Character	30	Type of cuisine	Italian

Write SQL commands to complete the tasks in (a) to (e).

(a) List the names and ratings of restaurants with a rating equal to or greater than 3, in descending order of the rating.

(3 marks)

(b) Calculate the average spending per person of those restaurants with 'Cafe' in their names.

(2 marks)

(c) List the names of restaurants in the district 'Mongkok'.

(2 marks)

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(d) List the number of restaurants offering Thai cuisine (i.e. `CUINAME = 'Thai'`) in each distri

(4 marks)

(e) List the district name which has the largest number of restaurants with a rating greater than 3.

(4 marks)

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4. A catering service company provides lunches to primary school students. Before the beginning of each month, students fill in a form, as below:

Meal Order Form							
Year/Month: 20 /							
Student name:					HKID number:		
Class:					Class number:		
Fill in meal type (A, B or C) for each day							
1 ☐	2 ☐	3 ☐	4 ☐	5 ☐	6 ☐	7 ☐	8 ☐
9 ☐	10 ☐	11 ☐	12 ☐	13 ☐	14 ☐	15 ☐	16 ☐
17 ☐	18 ☐	19 ☐	20 ☐	21 ☐	22 ☐	23 ☐	24 ☐
25 ☐	26 ☐	27 ☐	28 ☐	29 ☐	30 ☐	31 ☐	
Meal sub-total (Number of meals ordered x $18):							
Meal with juice: Yes / No If yes, add $150.							
TOTAL:							
Payment method (Blacken the square)							
☐ Convenience shop ☐ Cheque ☐ Phone payment Transaction / Cheque / Payment number: _____							

(a) The following is ***part*** of a data dictionary that represents the meal order form for one of the schools.

Field name	**Data type**	**Width**	**Description**
SCHNAME	Character	50	School name
STNAME	Character	50	Student name
HKIDNO	Character	11	Student's HKID number
CLASS	Character	2	Class
CLASSNO	*x*		Class number
JUICE	*y*		Meal with juice (Yes / No)
TOTAL	Real		Total amount
PAYMETHOD	Character	1	Payment method: C: convenience shop Q: cheque P: phone payment
PAYMENTNO	Character	10	Transaction / Cheque / Payment number

(i) TOTAL seems to be unnecessary in the data dictionary. Why?

_____

_____

(ii) Other than Character, suggest suitable data types for *x* and *y*.

x : _____ *y* : _____

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(iii) Illustrate the domain integrity in the above design.

(5 marks)

(b) Parents complain about the need to provide HKID numbers and student names. What should the following people do in order to prevent this kind of complaint?

Database designer: _____

Data entry operator: _____

(2 marks)

(c) The company serves many schools and wants to store all meal orders. It designs a Third Normal Form (3NF) database table, `MEALPLAN3`, with the following field names.

Field name	Description
`STNO`	Unique student number
`MEALDATE`	Date for the meal
`MEALTYPE`	Meal type

(i) Explain why `MEALPLAN3` is in 3NF.

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(ii) The company defines the database table

```
MEALPLAN1(STNO, Y, M, MEALTYPE01, MEALTYPE02, ... , MEALTYPE3
```

where the 31 fields, `MEALTYPE01`, `MEALTYPE02`, `...` , `MEALTYPE31`, store the meal types for the days of the month `M` and year `Y`.

Is `MEALPLAN3` better than `MEALPLAN1`? Explain briefly.

(5 marks)

(d) The records of all meal orders will be analysed using data mining. Suggest an example of data to be mined and explain how it can be used by the company to improve its service.

(2 marks)

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Database (SQL commands - based on SQL-92 Standard)

Constants	FALSE, TRUE
Operators	+, –, *, /, >, <, =, >=, <=, <>, %, _ , ' , AND, NOT, OR
SQL	ABSOLUTE (ABS), AVG, INT, MAX, MIN, SUM, COUNT ASC, AT, CHAR (CHR), CHAR_LENGTH (LEN), LOWER, TRIM, SPACE, SUBSTRING (SUBSTR/MID), UPPER, VALUE (VAL) DATE, DAY, MONTH, YEAR ADD, ALL, ALTER, ANY, AS, ASC, BETWEEN, BY, CREATE, DELETE, DESC, DISTINCT, DROP, EXISTS, FROM, GROUP, HAVING, IN, INDEX, INNER JOIN, INSERT, INTEGER, INTERSECT, INTO, LEFT [OUTER] JOIN, LIKE, MINUS, NULL, RIGHT [OUTER] JOIN, FULL [OUTER] JOIN, ON, ORDER, SELECT, SET, TABLE, TO, UNION, UNIQUE, UPDATE, VALUES, VIEW, WHERE

Symbols Used in Entity-Relationship Diagrams

Meaning	Symbol	Meaning	Symbol
Entity	Entity	One-to-one Relationship	1 Relationship 1
Attribute	Attribute	One-to-Many Relationship	1 Relationship M
Key Attribute	Attribute	Many-to-Many Relationship	M Relationship N
Relationship	Relationship	Participation constraints: Use | on Mandatory side Use ◯ on Optional side	Relationship

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PP-DSE
ICT
PAPER 2B

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PRACTICE PAPER
INFORMATION AND COMMUNICATION TECHNOLOGY
PAPER 2B
Data Communications and Networking
Question-Answer Book

(1 hour 30 minutes)
This paper must be answered in English

INSTRUCTIONS

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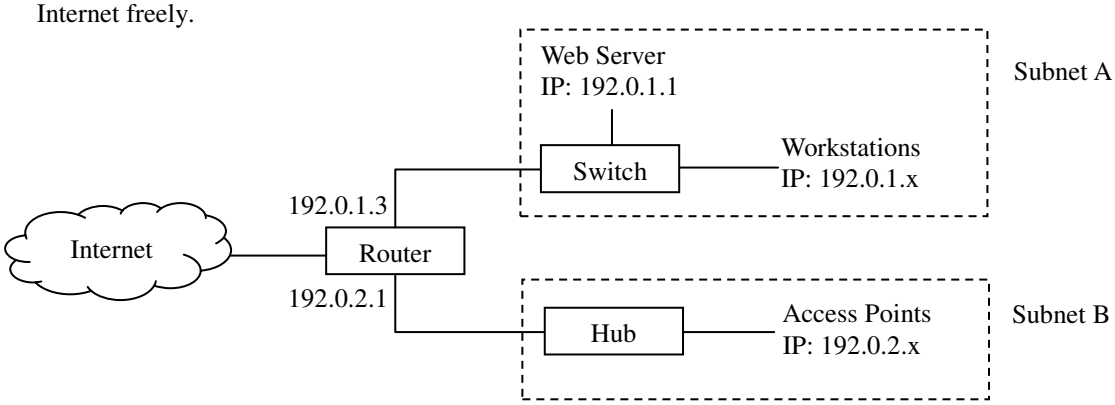
Answer all questions.

1. Ada is a network administrator. She sets up a network for a museum. The network is divided into two subnets, Subnet A and Subnet B. Subnet A consists of a web server and a number of workstations for the staff. Subnet B consists of a number of wireless access points (APs) for visitors to use to connect to the Internet freely.



(a) What kind of network topology is used in this network? Give one advantage and one disadvantage of this topology.

Network topology: _____

Advantage: _____

_____

Disadvantage: _____

_____

(3 marks)

(b) Ada wants to replace the hub in Subnet B with a switch. Give **two** advantages of a switch over a hub.

_____

_____

_____

(2 marks)

(c) (i) Name the devices in Subnet B using CSMA/CD and CSMA/CA.

CSMA/CD: _____

CSMA/CA: _____

(ii) Ada finds that the network throughput decreases greatly when the number of connections to the APs increases by only two. Why?

_____

_____

(4 marks)

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(d) In Subnet A, the IP address of the switch is 192.0.1.2 and the IP addresses of the workstations range from 192.0.1.4 to 192.0.1.21.

(i) Which class of IP addresses is being used? _____

(ii) Give the subnet mask and default gateway.

Subnet mask: _____

Default gateway: _____

(iii) Suggest a method for assigning IP addresses to the workstations in Subnet A. Give one advantage and one disadvantage of your suggestion.

_____

_____

_____

_____

(iv) In terms of IP address translation, explain how the web server in Subnet A can be accessed via the Internet.

_____

_____

_____

_____

(7 marks)

(e) A USB printer is to be shared among the workstations in Subnet A.

(i) Describe, step by step, how to share the printer among the workstations.

_____

_____

_____

(ii) Give one disadvantage of the printer sharing in (e)(i).

_____

_____

(3 marks)

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2. Peter is the network administrator in a secondary school.

(a) Peter wants to find a solution for each of the following problems:

P1: the spread of computer viruses due to the use of USB flash memory
P2: data loss due to the accidental deletion of files stored in a server
P3: data loss due to the accidental breakdown of a hard disk
P4: the impact on the servers of the accidental cut-off of electricity supply

Complete the following table to show the hardware / software required for solving the problems and describe the solutions briefly.

	Hardware / Software required	Description
P1		
P2		
P3		
P4		

(8 marks)

(b) One day, some teachers report that they cannot access the school web site from the workstations in the school.

In each of the following scenarios, what kind of hardware problem can Peter deduce?

(i) The teachers can browse other web pages in the Internet.

(ii) The teachers can browse the school web pages by using its public IP address.

(iii) The teachers fail to access the Internet using IP addresses of web sites, but they can access all the school network resources.

(3 marks)

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(c) A teacher connects his own notebook computer to the school network but he cannot access the Internet and school network resources. Describe how Peter uses some commands and/or utility programs to diagnose and solve the networking problems.

(4 marks)

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3. Mr Li sets up a computer network in a secondary school. He wants to set the following restrictions:

R1: Forbid students to browse the web sites with indecent materials.
R2: Forbid students to use the workstations to communicate with external computers directly.
R3: Forbid students to download files from the Internet using the FTP.
R4: Forbid students to install software in the workstations.

(a) Mr Li can use either a proxy server or a firewall to set R1. The two devices adopt content filtering and packet filtering respectively.

(i) How do the proxy server and the firewall perform filtering differently?

(ii) Mr Li considers using the proxy server only. Give one advantage and one disadvantage.

(4 marks)

(b) Describe how Mr Li administers the network so as to set the following restrictions.

(i) R2:

(ii) R3:

(iii) R4:

(6 marks)

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(c) To make the maintenance of the computers easier, Mr Li needs to access the school network t
the Internet. Hence, he needs to establish a secure channel for transferring data.

(i) Suggest a method that Mr Li could use.

_____

(ii) Give **two** disadvantages of the suggestion in (c)(i).

_____

_____

_____

_____

(3 marks)

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4. Mary is a network administrator. She is setting up a wireless network with a number of wireless access points (APs) in a library. Hence, readers can use their own mobile devices to connect to the Internet.

(a) (i) Other than a notebook computer, suggest **two** kinds of mobile devices that can connect to the APs.

_____

_____

(ii) Which hardware component in these mobile devices is the key part for the Internet connection?

_____

(3 marks)

Mary sets up two wireless local area networks, LIB-Y5a and LIB-Y5b, in the library for testing purposes. She uses a notebook computer to detect the wireless networks and has the following results:

SSID	Strength
LIB-Y5a *Unsecured wireless network*	✦✦✦✦✦✧
PUB-Y5 *Unsecured wireless network*	✦✦✧✧✧✧
LIB-Y5b *Security-enabled wireless network*	✦✦✦✦✦✦
HKEAA1 *Security-enabled wireless network*	✦✧✧✧✧✧
eaa *Security-enabled wireless network*	✦✦✦✧✧✧

(b) (i) Must the Service Set Identifier (SSID) of the wireless networks detected be unique? Explain your answer briefly.

_____

_____

_____

(ii) Why can some other wireless networks be detected?

_____

_____

(3 marks)

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Mary suggests two methods of connecting to a wireless network that can improve the network secu
illustrated in Figure 1 and Figure 2 below.

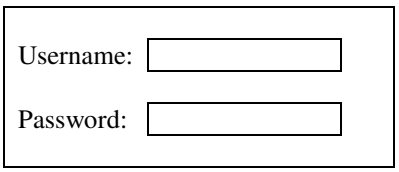

Figure 1

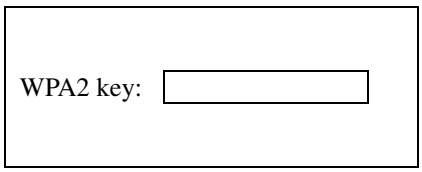

Figure 2

(c) (i) In each of the following boxes, put a '✓' if the corresponding method can be implemented for the network. Otherwise, put a '✗'.

	LIB-Y5a	LIB-Y5b
Figure 1		
Figure 2		

(ii) What is the main purpose of each method in maintaining the network security?

Figure 1: _____

_____

_____

Figure 2: _____

_____

_____

(iii) Does the method illustrated in Figure 1 require extra service or hardware? If yes, what?

_____

_____

(5 marks)

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(d) Peter is a reader. His computer detects the SSID of the free wireless network provided by the l
His friends successfully connect to the network but he is unable to connect. Give **two** network-rel
reasons for this.

(2 marks)

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PP-DSE
ICT
PAPER 2C

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Candidate Number									

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY
HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

PRACTICE PAPER
INFORMATION AND COMMUNICATION TECHNOLOGY
PAPER 2C
Multimedia Production and Web Site Development
Question-Answer Book

(1 hour 30 minutes)
This paper must be answered in English

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5 and 7.

(2) **ANSWER ALL QUESTIONS.** Write your answers in the spaces provided in this Question-Answer book. Do not write in the margins. Answers written in the margins will not be marked.

(3) Supplementary answer sheets will be supplied on request. Write your candidate number, mark the question number box and stick a barcode label on each sheet, and fasten them with string **INSIDE** this book.

(4) No extra time will be given to candidates for sticking on the barcode labels or filling in the question number boxes after the 'Time is up' announcement.

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Answer all questions.

1. Peter is the web designer of an online discussion forum. Members of the forum upload files to share with others, and most of the files are videos. He decides to set up a video-sharing web site for members to upload, share and view videos.

(a) (i) It is found that the extensions of the files uploaded by the members include:

avi, doc, flv, mov, mp3, mpg, pdf, php, rm, wmv

Which of these are video file types?

(ii) Suppose the web site supports all video formats. Give **two** advantages of this configuration.

(4 marks)

(b) Peter decides that all the videos uploaded should be converted to a standard format.

(i) Peter proposes that the videos should adopt the same video file format and have a low frame rate. Give **two** advantages of this proposal for web site development.

(ii) Suggest **two** more attributes in which the videos can be standardised.

(4 marks)

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(c) Peter considers the following two methods of sending videos to members.

Method 1: Send the entire video to members before they watch it.
Method 2: Send the videos to members and they can watch them instantaneously.

(i) Give **two** potential advantages of each method.

Method 1: _____

_____

_____

_____

Method 2: _____

_____

_____

_____

(ii) Peter uses an embedded player in the design. Give **two** advantages of using the embedded player.

_____

_____

_____

(6 marks)

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2. Amy is a web designer. She designs a web site to promote monuments to tourists in Hong Ko creates two different designs for the first page of the web site, both with text and images.

Design 1 (The descriptions of all monuments are shown on a single page.)

List of Monuments in Hong Kong

香港大學本部大樓 Main Building, HKU

The Main Building of the University of Hong Kong is the oldest of the University's structures. Construction of the building started in 1910 and was completed in 1912. It is an imposing institutional structure, supported by granite colonnades in Renaissance style and surmounted by a tall clock tower and four turrets.

香港大學大學堂 University Hall, HKU

University Hall, which is situated on top of a hill in Pokfulam, is a charming edifice in a blend of Tudor and Gothic architectural styles. It was built in about 1861 by a Scottish businessman, Douglas Lapraik, as his headquarters and residence and named "Douglas Castle" after him.

…… ……

…… ……

Design 2 (Images of all monuments are shown on the first page. When an image is clicked, the description of the corresponding monument will be shown.)

Design 2A (First page)

List of Monuments in Hong Kong

Main Building, HKU
香港大學本部大樓

University Hall, HKU
香港大學大學堂

Government House
香港禮賓府

Western Market
舊上環街市

St. John's Cathedral
聖約翰座堂

Old Supreme Court
舊最高法院

…… …… ……

…… …… ……

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For example, if the image of 'University Hall, HKU' is clicked, the following page is shown:

Design 2B

香港大學大學堂
University Hall, HKU

University Hall, which is situated on top of a hill in Pokfulam, is a charming edifice in a blend of Tudor and Gothic architectural styles. It was built in about 1861 by a Scottish businessman, Douglas Lapraik, as his headquarters and residence and named "Douglas Castle" after him.

(a) Compare the two designs from the user's point of view. Give **three** differences between them. For each of them, give and justify your preference.

(3 marks)

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(b) Suggest a web page design method for aligning the information in the way shown in Design 2A.

(1 mark)

(c) In Design 2A, Amy shows the names of monuments as images.

(i) Give **two** disadvantages of showing English words in this way.

(ii) Give one advantage of showing Chinese characters in this way.

(3 marks)

(d) To reduce the download time of the images in Design 2A, Amy uses images with reduced file sizes. Suggest **three** ways in which Amy can reduce the file size of the images.

(3 marks)

(e) Amy wants to show the images in Design 2A using interlacing. Give the main advantage of this technique.

(2 marks)

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(f) Amy takes photos of a certain monument from different angles at a resolution of 1 600 × 1 200. Then she joins them together and forms a wider image with a resolution of 16 000 × 1 200. Although 10 photos with the same height are enough to create this image, Amy decides to take pictures at two different elevation angles and at least 11 pictures for each angle. Why?

(2 marks)

(g) Amy wants to prevent people from downloading the photos of the monuments directly during web browsing. Suggest **two** methods for Amy to do this.

(2 marks)

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3. Janice is a web designer. She is designing a web site for Easy Travel Agency. The first page of the is sketched below:

(a) Janice first draws the company logo using a vector graphics software package. Then, she exports the logo using the filename 'logo.gif' with a resolution of 50 × 30.

(i) Why does Janice need to export the logo in another format instead of using the logo in vector graphics format directly?

(ii) Give **two** reasons to explain why Janice wants to export the logo in GIF format instead of JPEG format.

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(iii) After inserting the logo into the web page, Janice feels that the web page will look much
the resolution of the logo is 150 × 90. There are two ways to alter the resolution:

(1) Use the HTML code '<img src="logo.gif" width="150">'.
(2) Use the vector graphics software package again to export the logo with a resolution of 150 × 90.

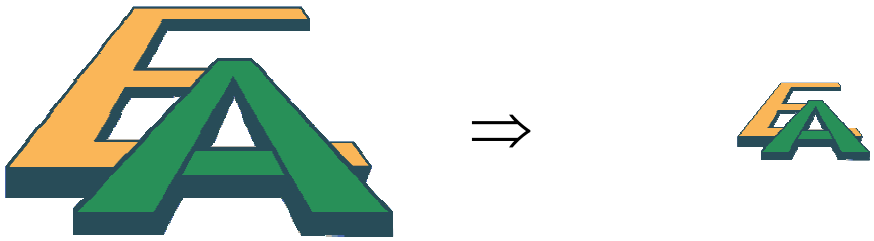
Which method do you suggest? Explain briefly.

(5 marks)

(b) Give **two** reasons to explain why Janice would like to have a text only page in addition to the graphical page in her web site.

(2 marks)

(c) Janice wants to create an animation to zoom out so that the logo of the company appears smaller, as shown below.



(i) Write down the steps to take to create this animation.

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(ii) Janice wants to set the number of frames per second for the animation as either 10 or 30. advantage of each setting.

(iii) Janice exports the animation as SWF format. Give **two** advantages of including a button for skipping the animation.

(iv) Suggest and describe another button for the animation.

(8 marks)

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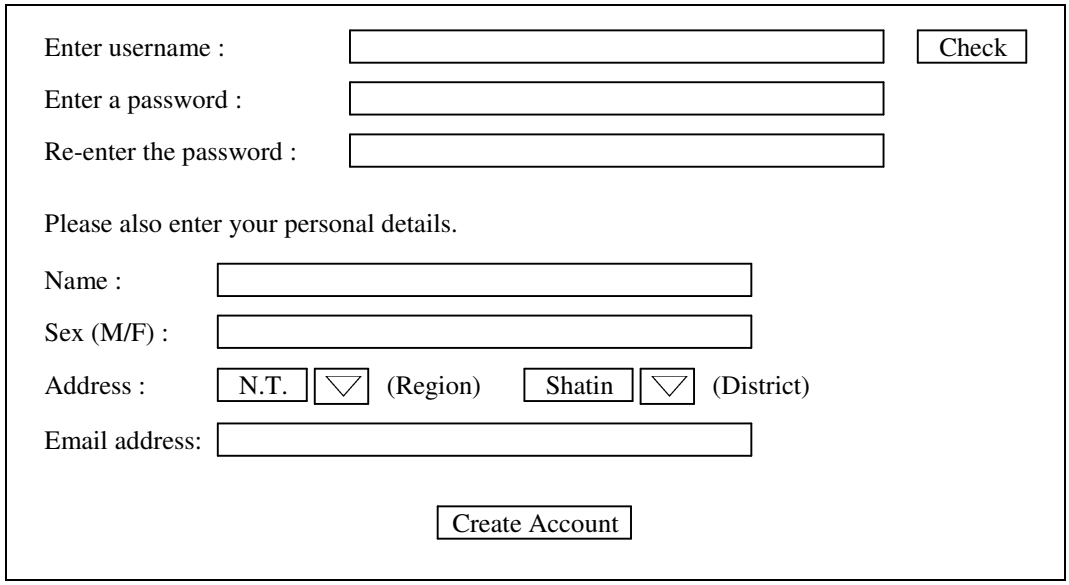
4. John would like to set up a discussion forum for members to share their travel experiences. Before up the forum, he has to design a web page where users can sign up for new accounts, as shown below.



(a) Suggest **two** methods of entering the sex of the user, other than using a text box.

_____

_____

(2 marks)

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To sign up for a new account, users enter a unique username and type the password twice for confirm
They can check whether the username has already been used by clicking the button 'Check'. All perso
details have to be filled in.

(b) To validate the username and password, John suggests three methods below:

Method 1: plain HTML codes
Method 2: client side scripts
Method 3: server side scripts

(i) Suggest a method, 1, 2 or 3, of validating each of the following items. If more than one method is normally applicable, write down the one with the lowest number.

(1) The username consists of alphanumeric characters only. _____

(2) The maximum length of a username is 10. _____

(3) The minimum length of a password is 6. _____

(4) The two passwords are identical. _____

(5) The username has not been used. _____

(ii) If pop-up windows with error messages are to be automatically shown during the validation process, which method is applicable? Justify your answer.

_____

_____

_____

_____

(7 marks)

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(c) After creating an account, users can log on to the discussion forum and post messages there.

(i) It is commonly said that the authentication process should be done on the server side due to security issues. Explain briefly why an authentication process done on the client side is insecure.

(ii) After logging on to the discussion forum, some authentication information about users, such as username, can be stored on the client side or server side.

(1) Where is the information stored on the client side?

(2) Give one advantage of storing such information on the client side.

(3) Describe how to transfer this authentication information across the web pages in the forum using hidden text in HTML.

(6 marks)

END OF PAPER

Sources of materials used in this paper will be acknowledged in the *Hong Kong Diploma of Secondary Education Examination Practice Papers* published by the Hong Kong Examinations and Assessment Authority at a later stage.

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PP-DSE
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PAPER 2D

HONG KONG EXAMINATIONS AND ASSESSMENT AUTHORITY

HONG KONG DIPLOMA OF SECONDARY EDUCATION EXAMINATION

PRACTICE PAPER
INFORMATION AND COMMUNICATION TECHNOLOGY
PAPER 2D
Software Development
Question-Answer Book

(1 hour 30 minutes)
This paper must be answered in English

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Candidate Number										
Programming Language Used (Please tick one)	Pascal ☐									
	C ☐									
	Visual Basic ☐									
	Java ☐									

INSTRUCTIONS

(1) After the announcement of the start of the examination, you should first write your Candidate Number in the space provided on Page 1 and stick barcode labels in the spaces provided on Pages 1, 3, 5 and 7.

(2) Tick the appropriate box for the programming language used. **No marks will be awarded if you tick either more than one box or no boxes.**

(3) **ANSWER ALL QUESTIONS.** Write your answers in the spaces provided in this Question-Answer book. Do not write in the margins. Answers written in the margins will not be marked.

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Answer all questions.

1. The following algorithm processes an integer array, M, with indices from 1 to n.

```
Step 1:  Initialise each element of M with a value equal to its index.
Step 2:  p ← 2
Step 3:  While p² ≤ n do Steps 4 to 7
Step 4:      q ← integer part of (n/p)
Step 5:      For i from 2 to q do Step 6
Step 6:          M[i * p] ← 0
Step 7:      p ← p + 1
```

Suppose n = 16. The content of M after the initialisation in Step 1 is shown below.

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

(a) (i) By using a loop, write the pseudo-code for Step 1.

_____

_____

(ii) Fill in the content of M after each of the first two passes of the loop in Step 3.

First pass

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

Second pass

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

(iii) How many times will the loop in Step 3 be executed? _____

(iv) List all the values of q in sequence when the loop in Step 3 is executed.

_____

(v) Study the pattern of values of M in (a)(ii). What is the purpose of the algorithm?

_____

(10 marks)

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(b) Suppose Step 5 is changed to:

For `i` from `p` to `q` do Step 6

What is the influence of this change on the algorithm? Explain your answer briefly.

(2 marks)

(c) The algorithm is implemented and compiled into a subroutine in a library. A main program is written using the subroutine.

(i) What kind of program, code generator, debugger, linker or loader, puts the executable file of the main program into the main memory for execution?

(ii) This subroutine will be linked to the executable file of the main program when the main program is running. Name this kind of linking method and give one advantage of it.

(3 marks)

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2. John writes a program to assist air traffic controllers at an airport to keep track of landing flights. The order of landing is handled on a first-come, first-served basis. Each flight is identified with a flight number, e.g. **A1**. John uses an array, `F`, to store a maximum of six flight numbers.

(a) `F[i]` stores the flight number of the flight that will land in the `i`-th position. i.e. `F[1]` stores the flight number of the flight that will land next.

Suppose that initially three flights **C3**, **A1** and **B2** will be landing, as shown below:

	F[1]	F[2]	F[3]	F[4]	F[5]	F[6]
Flight number	**C3**	**A1**	**B2**			

(i) (1) Flight **C3** has landed and flight **Z6** joins the queue for landing. Complete `F` below.

	F[1]	F[2]	F[3]	F[4]	F[5]	F[6]
Flight number	**A1**					

(2) Then, flight **A1** has landed and two more flights, **S19** and **T20** subsequently, join the queue for landing. Complete `F` below.

	F[1]	F[2]	F[3]	F[4]	F[5]	F[6]
Flight number						

(ii) Although the manipulation of `F` above is straightforward, it is not a good algorithm. Why not? Explain your answer briefly.

(3 marks)

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(b) Instead, John uses the following data structure to manipulate the order of landing. Two integer variables, `X` and `Y`, are used to hold two array indices of `F`.

	F[1]	F[2]	F[3]	F[4]	F[5]	F[6]
Flight number	**C3**	**A1**	**B2**			

`X = 1` `Y = 3`

- After a flight has landed, `F[X]` will **not** be re-used. Then, `X` is increased by 1.
- When a flight joins the queue for landing, `Y` is increased by 1 and its flight number is assigned to `F[Y]`.

(i) What are the purposes of `X` and `Y` in the implementation of the data structure?

(ii) Suppose that, at the beginning flights **C3**, **A1** and **B2** are subsequently waiting for landing with `X = 1` and `Y = 3`.

(1) Flight **C3** has landed and flight **Z6** joins the queue for landing. Complete `F`, `X` and `Y` below.

	F[1]	F[2]	F[3]	F[4]	F[5]	F[6]
Flight number	**C3**					

X = ☐ Y = ☐

(2) Then, flight **A1** has landed and two more flights, **S19** and **T20**, subsequently join the queue for landing. Complete `F`, `X` and `Y` below.

	F[1]	F[2]	F[3]	F[4]	F[5]	F[6]
Flight number	**C3**					

X = ☐ Y = ☐

(iii) To determine whether all waiting flights have landed, what condition should be checked?

(iv) What kind of error would occur if another flight **E5** joined the queue for landing after **T20** in (b)(ii)(2)?

(8 marks)

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(c) John wants to develop some new systems to replace the current systems in the airport. **Tasks 1, 2 and 3** should start after having collected user requirements (**Task 0**).

Task	Weeks to complete	Description
Task 0	5	Collect user requirements.
Task 1	20	Write, test and debug **ATC** System for air traffic controllers to use.
Task 2	15	Install display panels for **FID** System as soon as the programmer starts working on **ATC** System.
Task 3	10	Write, test and debug programs for **FID** System, after **ATC** System is completed and the display panels are installed.

(i) Complete the Gantt chart for John below.

No. of weeks / Task	5	10	15	20	25	30	35	40	45	50
Task 0										
Task 1										
Task 2										
Task 3										

(ii) Which strategy of systems conversion should John use? Explain your answer briefly.

(4 marks)

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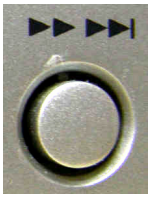
You are not allowed to add any new variables when answering Question 3. If variables are added, no marks will be awarded.

3. A program is written to emulate the selection of a track in a CD player. When the player loads a CD, the total number of tracks will be read and the default track number is 1. Pressing the buttons on the player results in the following actions:

Backward	Forward
	
When this button is pressed, the previous track will be played.	When this button is pressed, the next track will be played.

You are going to write some subprograms with the following variables to emulate the selection of a track.

Variable	Description
`TrackNum`	An integer variable to store the current track number
`TrackTotal`	An integer variable to store the total number of tracks

(a) Suppose the initial track number is 1 and total number of tracks is 13. Write a subprogram or a class, `LoadInit`, to initialise `TrackNum` and `TrackTotal`, and return the two values using call by reference.

(3 marks)

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(b) Write a function, `BackTrack`, to return the track number after the 'Backward' button is pr... the current track number is 1, it remains unchanged. `TrackNum` should be passed to this fun... using call by value.

(3 marks)

(c) Write a function, `NextTrack`, to return the track number after the 'Forward' button is pressed. If the next track number exceeds the total number of tracks, the track number is set to 1. `TrackNum` and `TrackTotal` should be passed to this function using call by value.

(2 marks)

(d) A new button, 'Shuffle', is to be emulated. When it is pressed, a track number will be randomly selected from 1 to `TrackTotal`.

A given function, `myrand`, without arguments can be called to return a random number r, where $0 \leq r < 1$.

Write a function, `shuffle`, to emulate the 'Shuffle' button. `TrackTotal` should be passed to `shuffle` using call by value.

(2 marks)

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(e) There should be a test plan to test the function written in Part (b). Suppose the total number of is 13. For each of two different scenarios, suggest a test value and state the expected results.

(1) Test value: _____

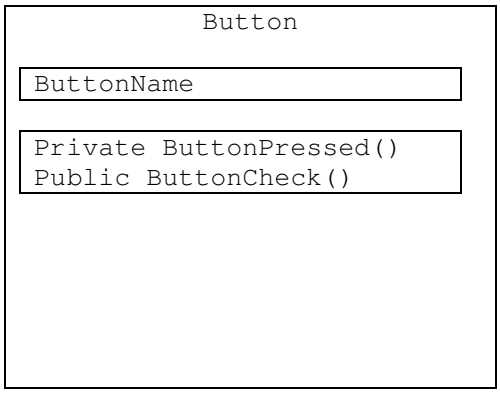
Expected result: _____

(2) Test value: _____

Expected result: _____

(2 marks)

(f) Suppose the program is written in an object-oriented programming language. The following *class* diagram represents button objects.



(i) How many methods are there in the class? _____

(ii) State the attribute of the class. _____

(iii) What is the class name? _____

(3 marks)

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4. A gas company uses a text file, `gas.txt`, to store the accumulated meter readings of clients. Each record consists of two text fields for a client: `accNum` and `accReading`. `accNum` stores the account number of clients and `accReading` stores the corresponding accumulated meter readings. The following example of `gas.txt`, which consists of four records, is represented in the diagram below.

accNum						accReading			
1	2	3	4	5	0	1	5	2	7
2	9	6	9	7	4	0	3	4	4
6	7	8	9	0	0	9	9	9	8
9	0	1	3	3	2	0	0	2	6

`accReading` consists of a string of four characters and its numeric value ranges from `0000` to `9999`. The consecutive value of `9999` in `accReading` is `0000`.

A subprogram, `usage`, is written to evaluate the number of units of gas consumed. The gas meter reading of the current month, `curReading`, is passed to the subprogram. The number of units consumed is then calculated and assigned to a global variable, `unitsConsumed`.

[Pascal version]

Line	Content
1	`var unitsConsumed : integer;`
2	`procedure usage(clientNum : string; curReading : integer);`
3	`var infile : text;`
4	`    clientFound : Boolean;`
5	`    ClientST, accNum, accReading : string;`
6	`    accValue : integer;`
7	`begin`
8	`    assign(infile, 'gas.txt'); reset(infile);`
9	`    clientFound := false;`
10	`    while not clientFound do begin`
11	`        readln(infile, ClientST);`
12	`        accNum := copy(ClientST, 1, 6);`
13	`        accReading := copy(ClientST, 7, 4);`
14	`        if clientNum = accNum then begin`
15	`            Part (a)(v)`
16	`            unitsConsumed := curReading - accValue;`
17	`            clientFound := true;`
18	`        end;`
19	`    end;`
20	
21	`    Part (c)`
22	`end;`

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[C version]

Line	Content
1	`int unitsConsumed;`
2	`void usage(char clientNum[], int curReading) {`
3	`    FILE *infile;`
4	`    int clientFound;`
5	`    char accNum[7], accReading[5];`
6	`    int accValue;`
7	
8	`    infile = fopen("gas.txt", "r");`
9	`    clientFound = 0;`
10	`    while (!clientFound)`
11	`    {`
12	`        fscanf(infile, "%6s%4s", accNum, accReading);`
13	`        if (strcmp(clientNum, accNum) == 0)`
14	`        {`
15	`            Part (a)(v)`
16	`            unitsConsumed = curReading - accValue;`
17	`            clientFound = 1;`
18	`        }`
19	`    }`
20	
21	`    Part (c)`
22	`}`

[Visual Basic version]

Line	Content
1	`Dim unitsConsumed As Integer`
2	`Sub usage(ByVal clientNum As String, ByVal curReading As Integer)`
3	`    Dim infile As IO.StreamReader`
4	`    Dim clientFound As Boolean`
5	`    Dim ClientST, accNum, accReading As String`
6	`    Dim accValue As Integer`
7	`    infile = IO.File.OpenText("gas.txt")`
8	
9	`    ClientST = infile.ReadLine()`
10	`    clientFound = False`
11	`    while Not clientFound`
12	`        accNum = ClientST.SubString(0, 6)`
13	`        accReading = ClientST.SubString(6, 4)`
14	`        If clientNum = accNum Then`
15	`            Part (a)(v)`
16	`            unitsConsumed = curReading - accValue`
17	`            clientFound = True`
18	`        End If`
19	`        ClientST = infile.ReadLine()`
20	`    End While`
21	`    Part (c)`
22	`End Sub`

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[Java version]

Line	Content
1	`static int unitsConsumed;`
2	`static void usage(String clientNum, int curReading) throws IOException {`
3	`    boolean clientFound;`
4	`    String ClientST, accNum, accReading;`
5	`    int accValue;`
6	
7	`    BufferedReader infile = new BufferedReader(new`
8	`    FileReader("gas.txt"));`
9	`    ClientST = infile.readLine();`
10	`    clientFound = false;`
11	`    while (!clientFound) {`
12	`        accNum = ClientST.substring(0, 6);`
13	`        accReading = ClientST.substring(6, 10);`
14	`        if (clientNum.compareTo(accNum) == 0) {`
15	Part (a)(v)
16	`            unitsConsumed = curReading - accValue;`
17	`            clientFound = true;`
18	`        }`
19	`        ClientST = infile.readLine();`
20	`    }`
21	Part (c)
22	`}`

(a) (i) It is known that the last digit of `accNum` is a check digit. What is the purpose of this check digit?

(ii) In terms of scope, what kind of variable is declared from Line 3 to Line 6?

(iii) What is the purpose of `clientNum` in calculating the gas consumed?

(iv) What is the purpose of `clientFound` in calculating the gas consumed?

(v) In Line 15, what operation on `accReading` should be carried out?

(5 marks)

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(b) The gas meter reading of the client with the account number `678900` in the current month is

(i) Suggest a problem that might be caused by the statement in Line 16.

_____

_____

(ii) Insert an IF statement after Line 16 to solve this problem.

_____

_____

(3 marks)

(c) Write a program statement in Line 21 to perform a proper file handling operation.

_____

(1 mark)

(d) The `while` loop might become an infinite loop.

(i) Why? _____

(ii) Rewrite the first line of the `while` loop to prevent this problem.

_____

(3 marks)

(e) The gas company has decided to replace the old system with a new system. A team of three members is responsible for developing the new system, as shown below:

- a project manager (PM);
- a system analyst (SA); and
- a programmer (P)

Match the major duties with the team members. The first one is an example.

Major duties	Team member
Assign resources and roles to members of the development team.	PM
Collect user requirements and write the user requirement specification.	
Set essential milestones of the development plan.	
Code the program and carry out testing.	

(3 marks)

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