

Name: _____

Class: _____



JURONG JUNIOR COLLEGE

JC2 Preliminary Examination 2018

**COMPUTING
Higher 2**

9597 / 2

11 September 2018

3 hours

Additional materials: Answer Paper

READ THESE INSTRUCTIONS FIRST

Write your index number and name on all the work you hand in.

Write in dark blue or black pen on both sides of the paper.

You may use an HB pencil for any diagrams, graphs, tables or rough working.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** the questions.

At the end of the examination, fasten all your work securely together, with the cover page in front.

The number of marks is given in brackets [] at the end of each question or part question.

This document consists of **11** printed pages.

[Turn over

1. J & J Dental Care has a team of freelance dentists. As there are two dental treatment rooms in the clinic, only two dentists may be on duty each day. The clinic manager finalises the monthly duty roster a week before the new month commences. Every patient has to either call or visit the clinic to book an appointment. The receptionist handling the booking will require the following details:

- patient name
- postal code
- dentist requested (optional)
- date requested

The receptionist checks the hard copy files to ensure that the patient is registered with the clinic and views the availability in the appointments book. After the dentist, date and time have been finalised, the patient's appointment will be recorded in the appointments book.

At the beginning of each day, the receptionist types an appointment list for each of the dentists working that day. The list contains patients' names and their respective timings.

When patients arrive at the clinic for their appointments, they announce their names to the receptionist and the receptionist will enter the treatment rooms to inform the dentists.

The clinic has decided to replace this manual system with a computerised system.

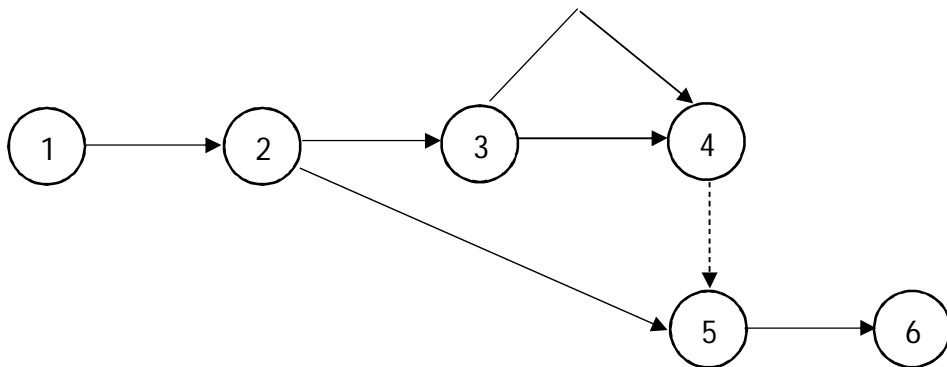
A system developer is employed to carry out the project. The first task assigned to the system developer is to write a project proposal.

- (a) One section of the project proposal is the Problem Statement which lists the problems in the current system. Write the Problem Statement. **[4]**
- (b) Explain why the problem must be defined accurately. **[2]**
- (c) Describe and justify three methods which can be used to determine the requirements for the computerised system. **[6]**
- (d) As a result of the analysis carried out, a diagram is used to show entities and data flow of the appointment booking process only. Draw a suitable diagram. **[6]**

The system developer has drawn up an initial plan of the work involved:

Stage	Activity	Weeks
A	Produce design	5
B	Identify requirements	3
C	Implement code	9
D	Perform black box testing	2
E	Perform acceptance testing	3
F	Prepare documentation	6

From the work breakdown, a Program Evaluation Review Technique (PERT) chart is constructed.



- (e) Complete the PERT chart by adding the stages and their respective durations in the correct sequence. [4]
- (f) State the critical path. [1]
- (g) State the minimum time in which the project could be completed. [1]
- (h) The first activity commences at Week 0. For activity D:
- state the earliest start time.
 - state the latest finish time. [2]
- (i) Two stages start and end at the same nodes.
- Re-draw the PERT chart by using an additional dummy stage separating them.
 - Explain the purpose of the dummy stage. [2]
- (j) List two types of documentation produced for this project. [2]

[Turn over

The computerised system will use a database. In the updated system the dentists will be given a hand-held device, that is networked, to use in their rooms for accessing the patient records.

(k) Describe two other uses for the hand-held device. **[2]**

(l) Describe a possible ethical concern raised by this new system. **[2]**

(m) An alternative solution for this project is to use cloud computing. Describe how each of the three types of cloud computing services may be used for the new project. **[6]**

2. The following are examples of hard copy documents managed by the receptionist at J & J Dental Care.

Patient name: Mark Lee Xiao Ming
 Patient address: 17 Toh Tuck Road, Singapore 596017
 Contact number: 67767515
 Allergies: None

Figure 1: Patient Record

01/09/2018	09:00 to 10:00	10:00 to 11:00	11:00 to 12:00	13:00 to 14:00	14:00 to 15:00	15:00 to 16:00	16:00 to 17:00	17:00 to 18:00
Dr Awang								
Dr Chew	Mark Lee Xiao Ming	Megan Wong			Joan Ang Lilian	Liu Che		Ling Low
Dr Mathu	Song Mei Ling	Joyce Ng		Wong Ah Yoke	Lester Tan	Izzy Chan	Tom Lee Yao	
Dr Sandra								

Figure 2: Appointments Book

Date: 01/09/2018
 Dentist name: Dr Mathu

09:00: Song Mei Ling
 10:00: Joyce Ng

Figure 3: Appointment List

Dentist name: Dr Mathu
 Dentist address: 6 West Coast Drive, Singapore 120006
 Contact number: 98833567

Figure 4: Dentist Record

(a) Explain why the patient name and postal code are needed when the receptionist handles an appointment booking for a patient. [2]

(b) Explain, using two examples, how such a system may compromise data integrity. [4]

(c) Describe, using an example, how such a system has data redundancy. [2]

(d) Each patient may book a maximum of one appointment per day. A fully normalised database solution to this problem is designed.

Draw an E-R diagram that shows these tables and the relationships between them. [4]

(e) Hence, write the table descriptions. You may introduce additional attribute(s). Underline the primary keys. [3]

(f) State three fields that require data validation. Suggest a suitable type of check for each field. [3]

3. The following is a byte stored in a file which contains binary code:

01101001

(a) What is the corresponding denary number? [1]

(b) What is the corresponding octal number? [1]

(c) An operating system provides a user interface to a computer system. List two types of interface that an operating system provides and state an advantage for each. [4]

(d) Many modern operating systems support Unicode.

- What is Unicode?
- What are two advantages of Unicode over ASCII? [3]

4. An object-oriented program is being written to store details about clients at a real estate agency.

Clients can be either sellers or prospective buyers. A class `Client` has been created and two subclasses, `Seller` and `Buyer` are to be developed. A `Location` class has been created to store details about an address (e.g. postal code, street name and district).

The `Client` class has data fields `Name`, `Address` and `DOB`. Part of the class definition for `Client` class is:

```
Client = Class
    // Private
    Name: String
    Address: Location
    DOB: Date

    // Public
    Constructor()
    Function GetName(): String
    Function GetDOB(): Date
    Function GetAddress(): Location
    Procedure SetDetails(String, Location, Date)
```

A `Buyer` has the following additional data fields:

- `NoOfBedroomsRequired`: stores the minimum number of bedrooms that the buyer requires in the property they purchase.
- `ParkingSpace`: stores a value indicating if the buyer requires parking or not.
- `AreaDesired`: the district the buyer is looking to purchase a property in. For example, Jurong is in district 22 while Orchard is in district 9.

- (a) Write the class definition for `Buyer`. [4]
- (b) Hence, illustrate the diagram which exhibits the relationships between all classes as well as inheritance and encapsulation. [6]
- (c) Explain why encapsulation is an important feature of object-oriented programming. [2]

[Turn over

5. The following shows a message being encrypted using a Caesar cipher.

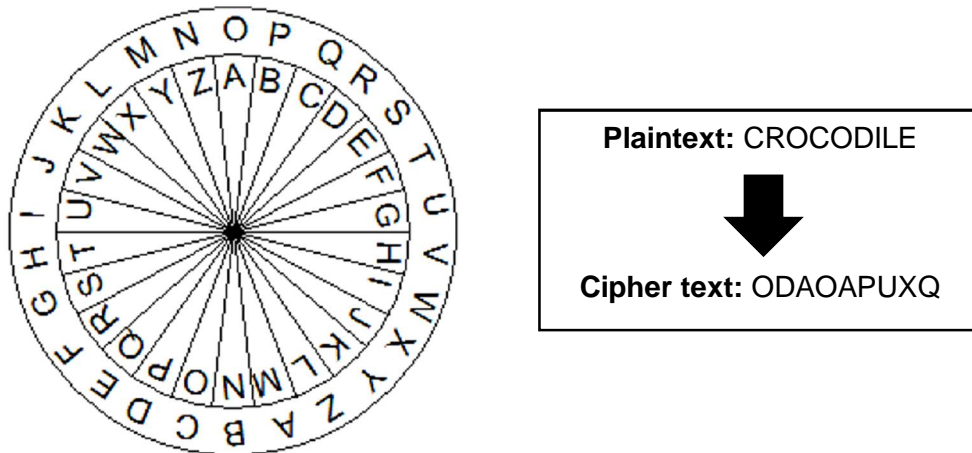


Figure 5: Wheel settings to use

- (a) Decrypt the cipher text "**QXQBTMZF**" using the Caesar cipher with the settings shown in Figure 5. [1]

In modern terminology, a Vernam cipher is a symmetrical stream cipher in which the plaintext is combined with a random or pseudorandom stream of data (the "keystream") of the same length, to generate the cipher text, using the Boolean "exclusive or" (XOR) function.

A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0

Using the Vernam cipher method, the plaintext "RUN" is to be encrypted. "RUN" will be encoded using 8-bit ASCII, according to the following ASCII table.

Letter	ASCII Code	Letter	ASCII Code	Letter	ASCII Code
A	01000001	J	01001010	S	01010011
B	01000010	K	01001011	T	01010100
C	01000011	L	01001100	U	01010101
D	01000100	M	01001101	V	01010110
E	01000101	N	01001110	W	01010111
F	01000110	O	01001111	X	01011000
G	01000111	P	01010000	Y	01011001
H	01001000	Q	01010001	Z	01011010
I	01001001	R	01010010		

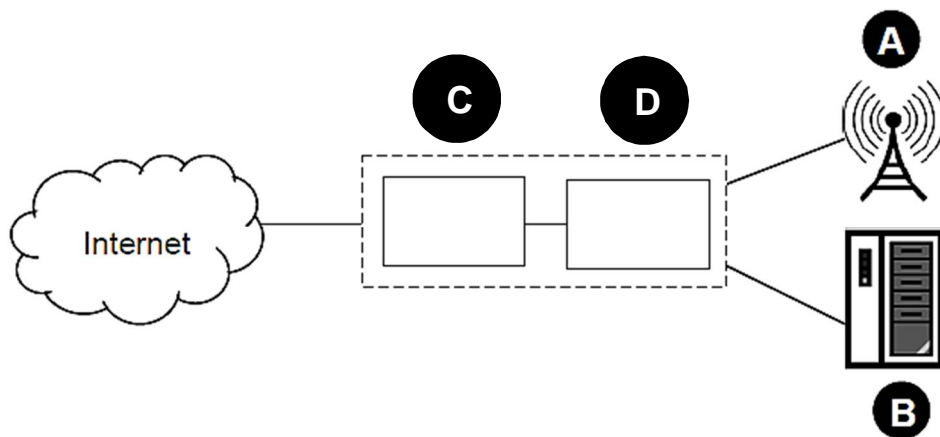
(b) The key 10111001 01001101 01000001 will be used to perform the encryption. Perform this encryption. Show your working to derive the cipher text from the plain text. [3]

(c) Both the Caesar and Vernam ciphers are symmetric ciphers. Explain the difference between a symmetric and an asymmetric cipher system. [1]

The following diagram shows the physical topology of a typical home Local Area Network (LAN) and its connection to the Internet. The LAN uses the IPv4 protocol.

Device A is a Wireless Access Point. A range of devices, including laptop computers and mobile phones connect to the network through the Wireless Access Point.

Device B is a Network Attached Storage device which is a server used to store files that can be accessed by other devices connected to the network.



(d) Identify the two networking devices (C and D). [2]

(e) The devices that are used within the home have private IP addresses. The Combined Device has both a private IP address and a public IP address. Explain the differences between private and public IP addresses, and why the Combined Device has both. [3]

(f) Describe two methods for ensuring the security of access to the files in Device B. [4]

[Turn over

6. The following pseudo-code contains an algorithm called `Merge` that is called by the `MergeSort` algorithm.

```

FUNCTION MergeSort(L, S, E)
  IF S < E THEN
    M ← (S + E) DIV 2
    L1 ← MergeSort(L, S, M)
    L2 ← MergeSort(L, M + 1, E)
    RETURN Merge(L1, L2)
  ELSE
    RETURN Append([], L[S])
  ENDIF
ENDFUNCTION

FUNCTION Merge(L1, L2)
  L3 ← []
  WHILE Len(L1) > 0 AND LEN(L2) > 0
    IF L1[1] < L2[1] THEN
      L3 ← Append(L2[1], L3)
      L2 ← RemoveFirstItem(L2)
    ELSE
      L3 ← Append(L1[1], L3)
      L1 ← RemoveFirstItem(L1)
    ENDIF
  ENDWHILE
  WHILE Len(L1) > 0
    L3 ← Append(L1[1], L3)
    L1 ← RemoveFirstItem(L1)
  ENDWHILE
  WHILE Len(L2) > 0
    L3 ← Append(L2[1], L3)
    L2 ← RemoveFirstItem(L2)
  ENDWHILE
  RETURN L3
ENDFUNCTION

```

The `RemoveFirstItem` function takes a list and returns a list that contains all the items in the original list except the first one. For example, if `Names` is the list `["Gemma", "Richard", "Georgina", "Margaret"]` then the function call `RemoveFirstItem(Names)` will return the list `["Richard", "Georgina", "Margaret"]`.

The `Len` function takes a list and returns the number of items that are in the list. For example, if `Names` is the list `["Gemma", "Richard", "Georgina", "Margaret"]` then the function call `Len(Names)` will return the value of 4.

The `Append` function takes an item and a list and returns a list that has all the items from the original list followed by the item. For example, if `Names` is the list `["Gemma", "Richard", "Georgina", "Margaret"]` then the function call `Append("Matt", Names)` will return the list `["Gemma", "Richard", "Georgina", "Margaret", "Matt"]`.

The first item in the list has an index of 1.

(a) What is meant by a recursive subroutine? [1]

(b) What is the base case for the subroutine `MergeSort`? [1]

(c) Complete the following table to show the result of tracing `MergeSort` with the function call `MergeSort(ListToSort, 1, 5)`. [4]

`ListToSort` is the list `[6, 3, 4, 8, 5]`. The first six rows and the call number column have been completed for you.

Call number	S	E	M	List returned
1	1	5	3	
2	1	3	2	
3	1	2	1	
4	1	1		[6]
3	1	2	1	
5	2	2		[3]
3				
2				
6				
2				
1				
7				
8				
7				
9				
7				
1				

(d) What is the time complexity for the `MergeSort` algorithm? [1]