

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2018
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALISATION PAPER FOR ICT

Date	: 7 October 2018
Total Marks	: 100
Writing Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to writing time)

GENERAL INSTRUCTIONS:

1. Write your Registration Number clearly and correctly on the Answer Booklet.
2. The first 15 minutes is being provided to check the number of pages of Question Paper, printing errors, clarify doubts and to read the instructions. You are NOT permitted to write during this time.
3. This paper consists of **TWO SECTIONS**, namely SECTION A & SECTION B:
 - **SECTION A** has two parts: Part I - 30 Multiple Choice Questions
Part II - 4 Short Answer QuestionsAll questions under SECTION A are COMPULSORY.
 - **SECTION B** consists of two Case Studies. Choose only **ONE** case study and answer the questions of your choice.
4. All answers should be written on the Answer Booklet provided to you. Candidates are not allowed to write anything on the question paper. If required, ask for additional Answer Booklet.
5. All answers should be written with correct numbering of Section, Part and Question Number in the Answer Booklet provided to you. Note that any answer written without indicating the Section, Part and Question Number will NOT be evaluated and no marks will be awarded.
6. Begin each Section and Part in a fresh page of the Answer Booklet.
7. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
8. Use of any other paper including paper for rough work is not permitted.
9. **You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.**
10. This paper has **11 printed pages**, including this instruction page.

GOOD LUCK

SECTION A

PART I: Multiple Choice Questions (30 marks)

Choose the correct answer and write down the letter of your chosen answer in the Answer Booklet against the question number e.g. 31 (d). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. Testing of a program's component is called _____.
 - a) Pilot Testing
 - b) System Testing
 - c) Unit Testing
 - d) Integration Testing
2. Who invented 'QWERTY' computer keyboard layout?
 - a) Bill Gates
 - b) Alexander Graham Bell
 - c) Christopher Latham Sholes
 - d) Steve Jobs
3. Process of modifying information system to meet the changing needs is called _____.
 - a) system upkeep
 - b) system maintenance
 - c) system modification
 - d) system management
4. Which of these is not one of the phase names defined by the Unified Process Model for software development?
 - a) Inception phase
 - b) Elaboration phase
 - c) Construction phase
 - d) Validation phase
5. How many usable IP addresses will be there in the class C network segment with a subnet mask of 255.255.255.192?
 - a) 32
 - b) 62
 - c) 92
 - d) 122
6. FIFO scheduling in operating system is _____.
 - a) Non preemptive scheduling
 - b) Deadline scheduling
 - c) Preemptive scheduling
 - d) Fair share scheduling

7. Which are two ways in which entities can participate in a relationship?
- a) Passive and Active participation
 - b) Complex and Simple participation
 - c) Total and Partial participation
 - d) Real and Assumed participation
8. What does an acronym CAN stands for?
- a) Controlled Area Network
 - b) Campus Area Network
 - c) College Area Network
 - d) Cluster Area Network
9. What would be the output for '*calculate(10)*' in the following java code?

```
int calculate(int n)
{
    int x = 0;
    x = calculate(n-1);
    return x;
}
```

- a) 0
 - b) 1
 - c) Compilation error
 - d) Run time error
10. DML is provided for _____.
- a) Description of logical structures of database.
 - b) Addition of new structures in the database system.
 - c) Manipulation and processing of database.
 - d) Definition of physical structure of database system.
11. What command is used in order to find the number of hops between the routers?
- a) Traceroute
 - b) Route
 - c) Ipconfig
 - d) Ifconfig
12. How many numbers of TCP connection would be required while transferring 3 files from server A to client B in the same session?
- a) 1
 - b) 2

- c) 3
- d) 4

13. The role of the packet sniffers is _____.

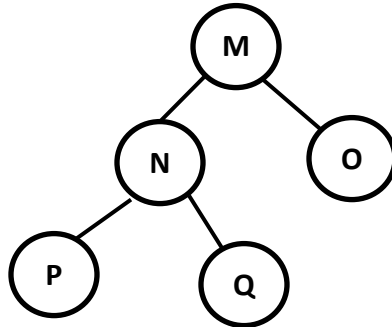
- a) Active receiver
- b) Passive receiver
- c) Active sender
- d) Passive sender

14. What does 'Rollback' in the following database operations do?

Some transactions.....;
commit;
Rollback;

- a) It undoes the transactions before commit.
- b) It clears all transactions.
- c) It redoes the transactions before commit.
- d) It has no effect on database.

15. In the given tree structure, what is the output of **Postorder** tree traversal?



- a) P Q N O M
- b) P N Q M O
- c) M N P Q O
- d) Q P N O M

16. What represents an 'attribute' in a relational database?

- a) Tables
- b) Rows
- c) Columns
- d) Records

17. Where do we send the IP packet whose destination is outside the local TCP/IP network segment?
- a) Firewall
 - b) File server
 - c) Default gateway
 - d) DHCP server
18. How many NOR gates are required to make an OR gate?
- a) 2
 - b) 3
 - c) 4
 - d) 5
19. 'The data used during the execution of a transaction cannot be used by a second transaction until the first one is completed'. Which of the following ACID properties is applicable?
- a) Consistency
 - b) Atomicity
 - c) Durability
 - d) Isolation
20. What would be the consequence of disabling IPv6?
- a) It stops working of network discovery.
 - b) It will have no effect to the local network.
 - c) It will increase the amount of network traffic.
 - d) It will decrease the amount of network traffic.
21. Which type of diagram is most common in project management software?
- a) Gantt chart
 - b) CASE tool
 - c) System flowchart
 - d) Data flowchart

22. What is the output of the following java code?

```
//Code Segment
class Parent
{
    public Parent() { System.out.print("Parent "); }
}
class Child extends Parent
{
    public Child() { System.out.print("Children "); }
}
class Grandchild extends Child
{
    public Grandchild() { System.out.print("Grandchildren "); }
}

public class MainClass
{
    public static void main(String[] args)
    {
        Grandchild C = new Grandchild();
    }
}
```

- a) Grandchildren
- b) Children Grandchildren
- c) Parent Children Grandchildren
- d) Grandchildren Children Parent

23. The simplified Boolean expression: $((A+B)' + C)'$ = _____.

- a) $AC' + BC'$
- b) $C' + AB$
- c) $A' + B' + C'$
- d) $AB + C'$

24. In which layer of OSI model does repeater operate?

- a) Data link layer
- b) Network layer
- c) Transport layer
- d) Physical layer

25. Which of the following is also referred as a set of physical addresses?

- a) Disk space
- b) Address space
- c) Memory space
- d) Locations

26. The proxy server keeps the copies of _____.
- Current requests
 - Recent requests
 - Incomplete requests
 - Received Requests
27. What is the octal equivalent of hexadecimal (B5A)?
- 5523
 - 5532
 - 5235
 - 5325
28. In a computer web, basic fundamental block is also known as _____.
- HTML element
 - HTML attribute
 - HTML body
 - HTML tag
29. What is the prefix expression of given infix expression: $(X+Y)*(Z+W)$?
- *+XY+ZW
 - XY+ZW+*
 - +XY+ZW*
 - +XY*ZW+
30. In a relation schema $R = (A, B, C, D, E)$ with functional dependencies: $\{A \rightarrow B, A \rightarrow C, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$, which of the following functional dependencies is NOT implied?
- $CD \rightarrow AE$
 - $BD \rightarrow AD$
 - $BC \rightarrow CD$
 - $AC \rightarrow AD$

PART II – Short Answer Questions (20 marks)

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks.

- To enhance the security of networks and systems of an organization, the network engineers are expected to ensure the highest level of security. With respect to their responsibilities, answer the following questions.
 - What are the methods used to secure WiFi Access Points? (2 marks)
 - How does subnets help to improve the security of the network and when do we use it? (2 marks)
 - Do you think that the standalone computer system is secure? (1 mark)

2. Write the SQL statements for the queries using the relation schema provided below:

employee (*employee-name, street, city*)
works (*employee-name, company-name, salary*)
company (*company-name, city*)

- a) Find the names, streets and cities of residence for all the employees who work for “Bank of Bhutan” and earns salary more than Nu 10,000. (2.5 marks)
- b) Find the names of all the employees who live in the same cities as the company for which they work. (2.5 marks)

3. You are given with following processes as shown in the table.

Process	Burst Time (ms)	Priority
P1	10	3
P2	1	1
P3	2	4
P4	1	5
P5	5	2

- a) Calculate the average waiting time of the processes in the given order (First-come-first-serve) without using priority. (2.5 marks)
- b) Calculate the average waiting time of the processes using the priority. (2.5 marks)

4. Compare open source software and proprietary software. (5 marks)

SECTION B

Case Study

Choose either Case I OR Case II from this section. Each case study carries 50 marks.

Case I

Database Management System

The objective of this case study is to design and develop a simple Hospital Database System (HDBS) for a new regional hospital in one of the Dzongkhags. The database should maintain the records of various departments and doctors in the hospital. It should also maintain records of patients visiting the hospital, the diagnosis and check-up of patients done by doctors, the patients admitted into hospital, patients discharged or referred to Jigme Dorji Wangchuk national referral hospital (JDWNRH) in Thimphu.

Description:

The new regional hospital has many departments such as Emergency, Pathology, Gynaecology, Dental, ENT, ICU, Blood Bank, Operation Theatre, Laboratory, Anaesthetics, MRI, etc. There is also Out-Patient department (OPD), where patients are registered and send to concerned doctor for diagnosis of their ailments. According to the ailments, doctors either prescribe medicine or admit the patients in the concerned departments for further diagnosis and treatment. After the treatment, the patients are either discharged or referred to Thimphu hospital in serious cases.

During the initial requirements gathering, following information and processes are documented.

- The department consists of various departments in the hospital with their name, location and facilities available.
- The doctors' information is required such as name, CID, qualification, gender, Phone number, address, etc. and the department they are associated with.
- When patients visit hospital, at the registration counter, the patient's information such as CID, name, age, gender, address, phone number, entry date and name of referred doctor are recorded on the prescription form. After the registration, patients are directed to the concerned doctor for check-up.
- During the check-up at a particular day, the referred doctor conducts diagnosis and provides treatment. The doctor also indicates the status of the patient, based on which the patients need admission into hospital or go home with medical prescriptions.
- If admitted into hospital, additional information is recorded, which includes department, room, date of admission, diagnosis, treatment, doctors under whom the treatments are done, and nurse(s) assigned. Finally, based on diagnosis, treatment and condition of the patient, the patient is either discharged or referred to JDWNRH. If discharged, the information recorded include treatments, prescribed medicines, date of discharge, and follow-up advice, if any. Likewise, if referred, additional information recorded are date of referral, diagnosis, treatment and condition of the patient.

Based on the above case study about HDBS, answer all the following questions:

1. In the given requirements of HDBS, study the processes of a patient visiting the hospital to receive medical services. Based on your identified processes, draw a complete Process Flow diagram. (8 marks)
2. To build a database for HDBS, it is important to model the database.
 - a) What is E-R model? Identify all the entities of the database given in the requirements. (2 marks)
 - b) Provide complete E-R diagram with entities, attributes, relationships and primary keys to model the database. (10 marks)

- c) In your E-R Model, if **Doctor-Patient** has many-many relationships, how can you implement such relationship in database design? Explain with an example. (5 marks)

3. While gathering requirements of HDBS, you came across the following data in the patient registration book.

CID	Patient Name	Age	Gender	Doctors referred
1234	Karma	18	Male	Dr. Sonam, Dr.Kezang
3445	Wangmo	65	Female	Dr. Kezang,
1249	Dechen	34	Female	Dr. Kezang, Dr. Pema, Dr. Arun
4578	Karma	25	Female	Dr. Pema
3120	Dorji	55	Male	Dr. Sonam, Dr. Dechen

Normalize the table into Third Normal Form (3NF). (8 marks)

4. To design and develop a system, you are required to make some prototypes.
- What is a prototype and provide one simple prototype of user interface from any one of the components of HDBS. (2 marks)
 - What are the benefits of prototyping during the system design? (3 marks)
5. For the development of HDBS:
- Provide some non-functional requirements of the system and explain them briefly. (5 marks)
 - Explain briefly some technologies and tools you would use to develop HDBS. (2 marks)
6. How does the project management triple constraints: **'Time, Cost and Scope'** of a system development project impact each other? (5 marks)

Case II

Network Design

Royal Civil Service Commission (RCSC) has planned to build its new secretariat building in the 12th Five Year Plan. There are six division and five service sections as per the organizational structure. In their new building, they have planned to segregate the sections and divisions into various logical groups to provide ease of management and better security. RCSC also provides online services such as Civil Service Information System (CSIS), Individual Work Plan (IWP) and Managing for Excellence (MAX) system to civil servants within its purview. They also plan to use appropriate technologies as per the requirements to minimize the number of servers being used to provide those

online services. Furthermore, RCSC encourages to share the common resources like printer, scanners and photo copiers. All users are authenticated with their unique employee ID to access network and services of RCSC.

Base on the above case study about Network Design, answer all the following questions:

1. Design the network topology diagram for the planned secretariat building as per the requirements, adopting the international best practices. You are provided with IP block of **172.33.32.0/21**. (10 marks)
2. Based on your judgement, which network topology is most suitable and efficient for RCSC network? (5 marks)
3. In order to minimize the number of servers being used to deploy the online services, what would be the appropriate choice of technology? Give reasons for your choice. (5 marks)
4. For the mobility of users using end devices such as mobile phones and personal digital assistants (PDAs), the secretariat plans to deploy very efficient WiFi network coverage.
 - a) Explain the primary design considerations for the wireless LAN. (5 marks)
 - b) Discuss various types of security protocols used to provide centralized access into networks. (5 marks)
 - c) Differentiate between licensed and unlicensed wireless frequency bands. (5 marks)
5. People visiting RCSC office may need to access the network and online services. Should RCSC allow free access to their network? Justify your answer with relevant techniques and associated risks. (5 marks)
6. Describe some of the techniques used in network security testing. (5 marks)
7. With the change in technology and some system requirements, RCSC has also planned to deploy IPv6 addressing along with existing IPv4 addressing in their new network. What are the mechanisms followed to deploy IPv6 along with IPv4? (5 marks)

TASHI DELEK