ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2019
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALISATION PAPER FOR ICT

Date : October 13, 2019
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 Questions

     All 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 **10 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. The Network Interface Card (NIC) in computer is usually used for
   a) Connectivity
   b) Scanning
   c) Printing
   d) Copying

2. While entering the data using keyboard, the communication between a computer and a keyboard involves _____ transmission.
   a) automatic
   b) half-duplex
   c) full-duplex
   d) simplex

3. Which of the following network was first implemented using TCP/IP protocol?
   a) CNNET
   b) ARPANET
   c) NSFNET
   d) ASAPNET

4. INSERT INTO instructor VALUES (10211, 'Smith', 'Biology', 66000); What type of statement is this?
   a) Query
   b) Relational
   c) Data Manipulation Language (DML)
   d) Data Definition Language (DDL)

5. Which protocol is used to find the hardware address of a host machine?
   a) RARP
   b) IP
   c) ARP
   d) ICMP

6. Following are the type of computer viruses EXCEPT
   a) Boot sector
   b) Polymorphic
   c) Multipartite
   d) Trojans

7. You attempt to query the database with this command:

   SELECT nvl (100 / quantity, NONE)

   FROM inventory;

   Why does this statement cause an error when QUANTITY values are null?
   a) The expression attempts to divide by a null value.
   b) The data types in the conversion function are incompatible.
   c) The character string none should be enclosed in single quotes (‘ ‘).
   d) A null value used in an expression cannot be converted to an actual value.

8. The expanded form for BIOS is _____.
   a) Basic Input Output Server
   b) Basic Input Output System
   c) Basic Internet Output System
   d) Battery-based Input Output System

9. Which one of the following makes 1 zettabyte?
   a) 1024 PB
   b) 1024 ZB
   c) 1024 TB
   d) 1024 EB

10. This Query can be replaced by which one of the following?

    SELECT name, course_id

    FROM instructor, teaches

    WHERE instructor_ID= teaches_ID;

    a) Select name, course_id from teaches, instructor where instructor_id=course_id;
    b) Select name, course_id from instructor natural join teaches;
    c) Select name, course_id from instructor;
    d) Select course_id from instructor join teaches;

11. When do we require decoder?
    a) Vertical Microinstruction
    b) Horizontal Microinstruction
    c) Multilevel Microinstruction
    d) All types of Microinstruction

12. What does the RAID stands for _____.
    a) Redundant Array of Individual Disks
    b) Reusable Array of Individual Disks
    c) Reusable Array of Independent Disks
    d) Redundant Array of Independent Disks

13. The decimal equivalent of the given binary number 10101 is _____.
    a) 13
    b) 21
    c) 31
    d) 12

14. From the given expression Y + X'.Y, which operator will be evaluated first?
    a) ‘
    b) +
    c) .
    d) ,

15. What does the following piece of code do?

```
for (int i = 0; i < arr.length-1; i++)
{
   for (int j = i+1; j < arr.length; j++)
   {
      if( (arr[i].equals(arr[j])) && (i != j) )
      {
         System.out.println(arr[i]);
      }
   }
}
```

    a) Print the element with maximum frequency.
    b) Print the unique elements in the array.
    c) Print the duplicate elements in the array.
    d) None of the above.

16. Which of the following gate is used to reverse the output and is also known as inverter?
    a) NOR
    b) NAND
    c) EXOR
    d) NOT

17. _____ was the first neural network computer ever built.
    a) RFD
    b) SNARC
    c) AM
    d) AN

18. In terms of speed and storage capacity, _____ computers are lower to mainframe computers.
    a) Super
    b) Mainframes
    c) Mini
    d) Hybrid

19. What is the alternative name for base?
    a) Radix
    b) Root
    c) Median
    d) Entity

20. The IEEE standard used for Wireless LAN is
    a) IEEE 802.10
    b) IEEE 802.11
    c) IEEE 802.12
    d) IEEE 802.13

21. There are _____ versions of IP's address.
    a) 6
    b) 4
    c) 2
    d) 0

22. The hexadecimal representation of 6578 is
    a) 1AF
    b) D78
    c) D71
    d) 32F

23. A CPU has two modes-privileged and non-privileged. In order to change the mode from privileged to non-privileged,
    a) a hardware interrupt is needed.
    b) a software interrupt is needed.
    c) a privileged instruction (which does not generate an interrupt) is needed.
    d) a non-privileged instruction (which does not generate an interrupt) is needed.

24. Everything below the system call interface and above the physical hardware is known as _____.
    a) Bus
    b) Shell
    c) Stub
    d) Kernel

25. What should be the output:

```
void main()
{
 int a = 10/3;
printf("%d",a);
}
```

    a) 3.33
    b) 3.0
    c) 3
    d) 0

26. What is true about 'private' members of a class?
    a) Private members can be accessed within a same package.
    b) Private members can be accessed within class only.
    c) Private members can be accessed within sub classes of same package.
    d) All of the above.

27. Department (dept name, building, budget) and Employee (employee_id, name, dept name, salary)

    Here the dept_name attribute appears in both the relations. Here using common attributes in relation schema is one way of relating _____ relations.

    a) attributes of common
    b) tuple of common
    c) tuple of distinct
    d) attributes of distinct

28. "Black" in the "Black-box" testing refers to / means
    a) Design is hidden
    b) Characters of the movie "Black"
    c) I – O is hidden
    d) Users are hidden

29. Top-down design in Software Engineering does not require
    a) Step-wise refinement
    b) Loop invariants
    c) Modularity
    d) Flow charting

30. Which of the following is a mechanism that allows several objects in a class hierarchy to have different methods with the same name?
    a) Aggregation
    b) Polymorphism
    c) Inheritance
    d) All of the above.

PART II – Short Answer Questions (20 marks)

This part has 4 Short Answer Questions. Answer ALL the questions. Each question carries 5 marks. Mark for each sub-question is indicated in the brackets.

1. What are zero-day threats and what are the methods used for stopping them? (5 marks)

2. Data mining is the process of looking at large banks of information to generate new information. With regard to this answer the following questions.

    a) What are the techniques used in data mining? (2 marks)

    b) Provide three each benefits and drawbacks of data mining. (3 marks)

3. You have table name Customer with CustomerID and CustomerName as follows:

CustomerID	CustomerName
1	Sonam
2	Sangay
3	Pema
4	Dema
5	Namgay
6	Karma
7	Tshering

   a) Write SQL queries to display the records with even CustomerID numbers. (1.5 marks)

   b) Write SQL queries to display the records with odd CustomerID numbers. (1.5 marks)

   c) Why do you prefer Iterative and Incremental Development Model over Water Fall Model in the Software Development Life Cycle. Give two reasons. (2 marks)

4. Write a program in this code provided to Print all the Prime Numbers: (5 marks)

```
 Void Main ()
{
   Int n =  30;

printf("Prime Numbers are: \n");
PrintPrimeNumber();
}

void PrintPrimeNumber(int n)
{
   …….
   …….
   …….
}
```

SECTION B: Case Study (50 marks)

Choose either CASE I or CASE II from this section. Each case study carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE I

The objective of this case study is to design and develop a simple Online Bus Ticketing System.

Description:

ABC Company desires to automate the ticketing system as part of the business transformation. The following information and processes are provided as an initial requirement gathering:

- Any user can login and check for schedule of buses using a username and password. User registration shall include name, address, contact number, email, gender.
- The Route details has schedule of every buses with information on departure date, departure time, bus number, capacity, status, fare, route name, source, destination and distance. Status attribute is to check the availability of the seat.
- User can book/reserve from the available seats for one or many passengers. The passenger information shall include name, address, date of birth, gender.
- Booking/reservation will generate a ticket that has information like ticket number, mode of payment which can be either by cash or online payment.

Based on the above requirement specifications, answer all the following questions:

1. Answer the following questions:
   a) What is use-case Diagram? (2 marks)
   b) Explain Include and Extend relationships in use-case diagram. Show examples. (4 marks)
   c) Draw a use-case diagrams with at least 4 use cases. Show their relationships (Association, Include, Extend and Generalization). (10 marks)
2. Answer the following:
   a) What is ER-Diagram? (2 marks)
   b) Draw ER-Diagram for the database design. (10 marks)
3. Answer the following:
   a) What is prototype? Why do you use prototyping for the system development? (4 marks)
   b) Design simple prototype for the Reservation component. (4 marks)

4. While you are going through data from above case study, you see data in the following format:

RESERVATION:

BusNo	BusName	Type	Status	BookingDate	TicketNo	Amount	SeatNo	Payment Mode
BP-1-1234	Meto	AC	Booked	1/5/2019	1231	200	21	Cash
BP-1-1234	Meto	AC	Booked	1/5/2019	1232	200	22	Online
BP-1-4321	Bumpa	Non-AC	Booked	1/5/2019	1233	150	23	Cash
BP-1-3412	Khorlo	AC	Booked	1/5/2019	1234	250	24	Online

a) What is Normalization? (2 marks)

b) Mention three advantages of functional dependency. (3 marks)

c) Mention three Anomalies. (3 marks)

d) Normalize the above table to 3rd Normal Form. (6 marks)

CASE II

Network Design

You as an ICT Officer working at Pemagatshel Dzongkhag is tasked to design the network for the upcoming new Dzong that is being built at Denchi town. In total there are over 100 users that will be working inside the Dzong premises. As per the architectural design and organizational structure of the Dzongkhag Administration, it is divided into various sections such as Administrative, Engineering, Accounts, Education and Health. These small units are spread across within the Dzong block. All the telecommunication links will be terminated at special room called meet me room. For the efficiency of day to day management and paperless initiative, the Dzongkhag uses local application such as Dispatching System, Human Resource Management Systems, Education Management System, Attendance System and Network Monitoring System. With the new Dzongkhag Administration being shifted to the new complex, other regional offices such as BAFRA, RSTA, RBP, Election Commission, Forest Range offices will be moving along with the Dzongkhag. The Dzongkhag has decided to build Wide Area Network (DzWAN) interconnecting all these regional offices with Dzongkhag enabling high speed connectivity. Convergence of this infrastructure will not only enhance the network security but will also eases the management. It is your responsibility to monitor and administer the network and services centrally from the Dzongkhag but at the same time users within Dzong and connected through DzWAN must have full confidence in the Dzongkhag WAN.

1. As per the given case study, design the network diagram for Pemagatshel Dzongkhag WAN. Your diagram should be properly labelled with IP address from the IP block of 172.16.0.0/18, nodes, physical media and segments. (10 marks)

2. Do you think that the Dzongkhag should have dedicated servers to host those applications or is it a good option to host in the cloud service provided by others? (5 marks)

3. Describe the common technologies that are used in Wide Area Network (WAN). Which technology would be most suitable for your DzWAN. (5 marks)

4. Give advantages and disadvantages of establishing the DzWAN. (5 marks)

5. Dzongkhag Administration is quite sceptical about the initiative of establishing of DzWAN. How you would be able to materialize this project? (5 marks)

6. Managing of DzWAN often becomes tedious task for network administrator as other regional offices will be connected to the Dzongkhag network besides the Dzongkhag users. Some of the most common issues of the network are because of rouge devices.

   a) What are rogue devices? (2 marks)

   b) What are types of rogue devices? (3 marks)

   c) How does rogue devices get connected to the network? (3 marks)

   d) What are the methods used to detect and prevent those rouge devices? (2 marks)

7. What do you understand by classful IP addressing and discuss some of its challenges? How are these problems addressed? (5 marks)

8. The network security systems help protect the assets, but a security system alone cannot prevent assets from being vulnerable to threat. To what extend do you agree? (5 marks)

TASHI DELEK