ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2023
EXAMINATION CATEGORY: <u>TECHNICAL</u>

PAPER III: SUBJECT SPECIALISATION PAPER FOR <u>ICT</u>

Date   : October 7, 2023
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 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 - 6 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 on 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 must hand over the Answer Booklet to the Invigilator before leaving the examination hall.**

10. This paper has **8 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. In a computer context, a byte corresponds to a_____ number of bits.
    a) 4
    b) 8
    c) 16
    d) 24

2. Which of the following tags is used to insert more than one graphic in the webpage?
    a) <img>
    b) <image>
    c) <images>
    d) <imgs>

3. Choose a valid statement that declares and initializes an array.
    a) int [ ] A   = {1,2,3}
    b) int [ ] A   = { }
    c) int [ ][ ] A = {1,2,3}
    d) int [ ] A   = (1,2,3)

4. What is the output when the following method has been executed?

```
void funcA()
  {
    int i, s = 0;
    for (int k = 0; k < 5; k++)
      {
        i = 0;
         do
         {
            i++;
            s++;
         } while (i < k);
      } System.out.println(s);
  }
```

    a) 10
    b) 11
    c) 15
    d) 9

5. What is the minimum header size of an IP packet?
   a) 17 bytes
   b) 14 bytes
   c) 24 bytes
   d) 20 bytes

6. In IPv4, class _____ has the greatest number of addresses in each block.
   a) A
   b) C
   c) D
   d) B

7. You need to subnet a network that has 5 subnets, each with at least 16 hosts. Which classful subnet mask would you use?
   a) 255.255.255.248
   b) 255.255.255.240
   c) 255.255.255.192
   d) 255.255.255.224

8. The process of evaluating data through analytical and statistical tools:
   a) data exploration
   b) data mining
   c) data analysis
   d) data rendering

9. Data that sits outside the trend is referred to as a:
   a) spike
   b) outlier
   c) trend
   d) Both (a) and (c)

10. What are the types of Machine learning?
    a) semi-supervised, supervised, and unsupervised
    b) semi-supervised, supervised, unsupervised, and reinforcement
    c) supervised and unsupervised
    d) None of the above

11. The binary equivalent of the decimal number 10 is:
    a) 10
    b) 1010
    c) 0101
    d) 0010

12. The first step in System Development Life Cycle is
    a) Planning and analysis
    b) Database design
    c) System design
    d) User interface design

13. What command is used to display only the enabled network interfaces that are connected to a system?
    a) ipconfig
    b) ifconfig
    c) Both A and B
    d) None of the above

14. The number of external nodes in a full binary tree with n internal nodes is:
    a) n
    b) n+2
    c) n+1
    d) n^2

15. Data encryption is primarily used to ensure
    a) data integrity.
    b) data availability.
    c) data non-repudiation.
    d) data confidentiality.

16. The two simultaneous VPN technologies used to guarantee privacy for an organization is _____ and _____.
    a) SSL and tunneling
    b) IPSec and SSL
    c) SSL and telnet
    d) IPSec and tunnelling

17. Applications and services running on distributed networks using virtualized resources is known as
    a) soft computing
    b) distributed computing
    c) cloud computing
    d) virtualized computing

18. Which of the following is not a DDL command?
    a) update
    b) create
    c) truncate
    d) alter

19. How can you change "Tshering" into "Pema" in the "LastName" column in the Users table?
    a) UPDATE User SET LastName = 'Tshering' INTO LastName = 'Pema'
    b) MODIFY Users SET LastName = 'Pema' WHERE LastName = 'Tshering'
    c) MODIFY Users SET LastName = 'Tshering' INTO LastName = 'Pema'
    d) UPDATE Users SET LastName = 'Pema' WHERE LastName = 'Tshering'

20. In the Bitcoin case, blockchain is used in a _____ way.
    a) centralized
    b) decentralized
    c) Both (a) and (b)
    d) None of the above

21. How is Web 3.0 different from Web 2.0?
    a) Web 3.0 was created as the internet for big tech corporations.
    b) The objectives of Web 3.0 focus on introducing interactive content to the internet.
    c) Web 3.0 emphasizes allowing control and ownership over data.
    d) Web 3.0 delivers a better user interface than web2

22. Which of this is not a Web Server?
    a) Nginx
    b) Apache
    c) Jigsaw
    d) HTTP

23. The primary function of a web server is to deliver web pages on the requests of clients using the
    a) hypertext transfer protocol.
    b) file transfer protocol.
    c) user datagram transfer protocol.
    d) simple mail transfer protocol.

24. Augmented reality (AR) provides features that are
    a) collaborative, virtual, and simulated.
    b) 3D, Visual and interactive.
    c) cost-efficient, sounds, and sensory.
    d) computer-generated, sensory, and virtual.

25. Which of the following is **NOT** a design principle when it comes to allowing the users to maintain control?
    a) Design for direct interaction with object that are displayed
    b) Provide flexible interaction
    c) Display technical internals from the casual users
    d) Allow user interaction to be undo-able

26. In the Model-view-controller (MVC) architecture _____ receives events.
    a) modulator
    b) transmitter
    c) receiver
    d) controller

27. Which of the following does not follow the MVC architecture pattern?
    a) laravel
    b) angular.JS
    c) react
    d) django

28. Which of the following typically tracks every online activity a victim engages in, aggregates all data in the background and sends it to third parties?
    a) Malware
    b) Spyware
    c) Adware
    d) Ransomware

29. Which of the following is the weakest secure encryption?
    a) WPA2
    b) WEP
    c) WPA3
    d) WPA

30. Which of the following principles is violated if the computer system is inaccessible?
    a) access control
    b) Authentication
    c) Availability
    d) confidentiality

PART II – Short Answer Questions [20 marks]

This part has 6 Short Answer Questions. Answer ALL the questions. Marks for each question are indicated in the brackets.

1. What is data encryption, and why is it important for data security? (3 marks)

2. What are the two main types of data encryption, and how do they differ? (2+2 marks)

3. What is data pseudonymization, and how does it differ from data anonymization? (3 marks)

4. Given an IP address of 192.168.10.0/24, calculate the number of host addresses available on each subnet. (2 marks)

5. What is the subnet mask for the IP address range 172.16.0.0 to 172.16.31.255? (2 marks)

6. Consider a database table named "Employees" with columns: EmployeeID, FirstName, LastName, Department, and Salary.

   a) Write an SQL query to retrieve the top 5 highest-paid employees along with their department. (3 marks)

   b) Write an SQL query to calculate the total number of orders and the average order amount for each customer from the "Orders" table. (3 marks)

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

Thimphu Thromde wants to implement a Database Management System (DBMS) along with a Mobile App to enable citizens to log in using their digital IDs and report water, drain, light, and garbage-related issues to the office. The system should store issue details, track their status, and allow the municipality to respond and resolve them efficiently.

Based on the above information,

1. What are the main entities involved in the Citizen Issue Reporting system? Provide a list of their attributes and identify the keys (8 marks)

2. Create a Level 0 Data Flow Diagram (DFD) for the Mobile App, illustrating the main modules and their interactions. (6 marks)

3. Identify the relationships between the entities. Specify the cardinality (one-to-one, one-to-many, or many-to-many) of each relationship. (4 marks)

4. What security measures should be implemented to protect citizens' sensitive information in the Mobile App and DBMS? List down the potential privacy concerns that might arise when citizens use the Mobile App to report issues. (5 +3 marks)

5. What role does data analytics play in the municipality's decision-making process using the DBMS data? (4 marks)

6. Explain the significance of implementing digital ID authentication and geolocation in the Mobile App. (4 marks)

7. Write an SQL query to retrieve all the issues that have an "Unsolved" status. (4 marks)

8. Write an SQL query to retrieve the top 3 most reported issues between two specific dates, ordered by the number of times each issue has been reported. (4 marks)

9. Write an SQL query to retrieve the names and email addresses of citizens who reported issues that are still open. (4 marks)

10. Write and SQL query to retrieve the total number of issues reported by each citizen? (4 marks)

CASE II

You are tasked with designing a logical network diagram to connect three different offices for a new business. The network should incorporate features such as redundancy, defining the necessary network layers, determining the appropriate media type to use, and preparing an IPv4 addressing plan. Present your design holistically for ultimate connectivity, reliability, and security.

1. Prepare a logical network diagram that illustrates the connections between the three office locations, including devices and links. Provide clear labels and descriptions for each element. (12 marks)

2. Identify and explain the layers of the network architecture required for this design. How does each layer contribute to the overall functionality of the network? (10 marks)

3. Develop an IPv4 addressing plan for the IP block of 172.33.32.0/21. Provide IP address ranges for each office location, including subnets for different departments if needed. (5 marks)

4. Determine the appropriate types of media to use for connecting the three office locations. Justify your choices based on factors like distance, bandwidth, and interference. (4 marks)

5. Outline the security measures you will implement to protect the network from unauthorized access and data breaches. (4 marks)

6. What is a VLAN (Virtual Local Area Network)? (3 marks)

7. Explain the concept of subnetting and why it's important in IP networking. (3 marks)

8. What is the purpose of DNS (Domain Name System) in a network? (3 marks)

9. What is latency in a network, and how does it affect network performance? (3 marks)

10. Explain the difference between a router and a switch in a network. (3 marks)

TASHI DELEK