

**ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2015
EXAMINATION CATEGORY: TECHNICAL**

PAPER III: SUBJECT SPECIALIZATION PAPER for *IT 4 Years*

Date	: 11 October 2015
Total Marks	: 100
Examination Time	: 150 minutes (2.5 hours)
Reading Time	: 15 Minutes (prior to examination time)

GENERAL INSTRUCTIONS:

1. Write your Roll 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 and 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 under your choice.
4. 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 any or correct Section, Part and Question Number will NOT be evaluated and no marks would be awarded.
5. Begin each Section and Part in a fresh page of the Answer Booklet.
6. You are not permitted to tear off any sheet(s) of the Answer Booklet as well as the Question Paper.
7. Use of any other paper including paper for rough work is not permitted.
8. You are required to hand over the Answer Booklet to the Invigilator before leaving the examination hall.
9. This paper has 12 printed pages in all, 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 the correct answer chosen in the Answer Booklet against the question number. E.g. 31 (c). Each question carries ONE mark. Any double writing, smudgy answers or writing more than one choice shall not be evaluated.

1. The four basic functions of CPU to perform its operations are:
 - a. Fetch, Decode, Execute and Store
 - b. Read, Decode, Fetch and Execute
 - c. Decode, Read, Execute and Store
 - d. Run, Decode, Fetch and Execute

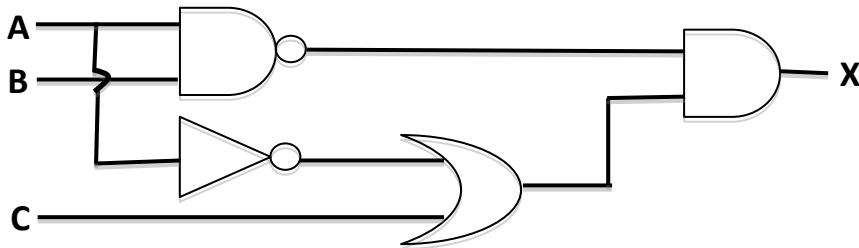
2. Which of the following database system model is in accordance with Parent-Child relationship in data processing?
 - a. Hierarchical
 - b. Object Oriented
 - c. Structural
 - d. Network

3. What of the following is the fastest sorting algorithm?
 - a. Insertion sort
 - b. Quick sort
 - c. Selection sort
 - d. Bubble sort

4. Which is the following statement regarding Protocol Data Unit (PDU) of different layers of OSI model is NOT true?
 - a. For Data Link Layer, PDU is the **frame**
 - b. For Transport Layer, PDU is the **data**
 - c. For Network Layer, PDU is the **packet**
 - d. For Physical Layer, PDU is the **bits**

5. Which of the following statement about XML is NOT correct?
 - a. XML is not dependent on hardware or software
 - b. XML is a markup language
 - c. XML tags are not case sensitive

- d. XML was designed to store and transfer data
6. Which of the following Boolean expressions correspond with the logic circuit given?



$$f = \overline{(A \cdot B)} + (\overline{A} \cdot C)$$

$$g = (\overline{A} + \overline{B}) \cdot (\overline{A} + C)$$

$$h = \overline{(A \cdot B)} \cdot (\overline{A} + C)$$

- a. **f** and **g**
- b. **g** and **h**
- c. **f** and **h**
- d. All of them
7. What is data scrubbing?
- a. A process to reject data from the data warehouse and to create the necessary indexes.
- b. A process to load the data in the data warehouse and to create the necessary indexes.
- c. A process to upgrade the quality of data after it is moved into a data warehouse
- d. A process to upgrade the quality of data before it is moved into a data warehouse
8. What is output of the following code?

```
//Java code for do-while loop
public class Loop {
    public static void main(String[] args) {
        int b=0;
        do{
            int a=2;
            b++;
            System.out.print(a++);
        }
        while (b!=3);
    }
}
```

- a. 012
- b. 222
- c. 333

d. 234

9. The output of the following code is:

//Code Segment

```
public class SomeProgram {  
    public static void main(String[] args) {  
        char c='2';  
        int a=3;  
        a= a + 'a';  
        switch(c) {  
  
        }  
        System.out.print(a);  
    }  
}
```

- a. 6
- b. 68
- c. 100
- d. Switch without any case, compile error

10. The value of hexadecimal number (A1C + 2BE) is:

- a. CDA
- b. B2F
- c. DBE
- d. E5A

11. Choose the correct statement(s) about the operating system:

- A. An operating system is needed to manage Hardware and Software.
- B. Fedora is a copyrighted operating system.
- C. Operating systems are type of Application software.

- a. A only
- b. C only
- c. A and B only
- d. B and C only

12. CISC stands for

- a. Complex Instruction Set Compilers
- b. Complex Instruction Set Computers
- c. Common Instruction Set Compilers
- d. Common Instruction Set Computers

13. Which of the following is/are necessary to use to protect the diodes in a rectifier and capacitor input filter circuit?
- Surge inductor
 - Surge capacitor
 - Surge resistor
 - All of the above
14. An amplifier has a large ac input signal. The clipping occurs on both the peaks. The output voltage will be nearly a:
- Sine wave
 - Square wave
 - Triangular wave
 - Irregular wave
15. The difference between Servlets and JSP is
- Translation
 - Compilation
 - Syntax
 - All of the above
16. The software used to drive microprocessor-based systems is called:
- Firmware
 - Assembly language
 - Machine language code
 - BASIC interpreter instructions
17. When referring to instruction words, a mnemonic is a:
- Short abbreviation for the operand address
 - Short abbreviation for the data word stored at the operand address
 - Shorthand for machine language
 - Short abbreviation for the operation to be performed
18. The bit strings for the sets are 1111100000 and 1010101010. The union of these sets is:
- 1010100000
 - 1010101101
 - 1111111100
 - 1111101010

19. Identify the correct statement: “Software engineers shall.....”
- Act in a manner that is in the best interests of his expertise and favour.
 - Act consistently with the public interest.
 - Ensure that their products only meet the SRS.
 - Ensure that the focus is given only to usage of technologies.
20. Which four framework activities are found in the Extreme programming?
- Analyzing, Designing, Coding, Testing
 - Planning, Analyzing, Listening, Coding
 - Coding, Testing, Listening, Designing
 - Planning, Analyzing, Coding, Implementing
21. A decision tree is a tree in which every node is either a _____ or a decision node.
- Leaf node
 - Root node
 - End node
 - Sub-node
22. Which of the following statements is/are purpose(s) of **uri** in HTML?
- A - Link to another document or resource
B - Link to external style sheet or script
C - Create an image map
- A and B
 - A and C
 - B and C
 - All of the above
23. On the upper layer of SSL, a protocol for initial authentication and transfer of encryption keys is called:
- SSL handshake protocol
 - SSL authentication protocol
 - SSL record protocol
 - SSL cipher protocol
24. What is multifold transformation?
- Converts data from one field into multiple fields
 - Converts data from multiple fields into single field

- c. Converts data from multiple fields into multiple fields
- d. All of the above

25. Which bitwise operator is suitable for checking whether a particular bit is **ON** or **OFF**?

- a. && operator
- b. & operator
- c. || operator
- d. ! operator

26. The simplified Boolean expression for given function using DeMorgan's theorem is:

$$F = \overline{(\overline{x} \cdot \overline{y}) \cdot (x + z)}$$

- a. $F = x + y + z$
- b. $F = x + y + \overline{z}$
- c. $F = x + \overline{y} + \overline{z}$
- d. $F = x + (\overline{y} \cdot \overline{z})$

27. Which of the following statement is NOT correct about the network devices:

- a. A hub does not manage any of the data traffic through it
- b. A switch forwards data packets using MAC address to the intended PCs
- c. A bridge usually has many ports
- d. A router distributes information between networks

28. XOR function can be realized using only:

- a. NOR gates
- b. NAND gates
- c. AND gates
- d. OR gates

29. All of the following IP address cannot be used EXCEPT?

- a. 192.168.0.0
- b. 127.0.0.1

- c. 127.0.0.10
- d. 192.168.0.255

30. In HTML, which following sets belongs to **Type Properties** of input elements of form?

- a. {radio, text, textarea}
- b. {radio, text, checkbox}
- c. {textarea, radio, textbox}
- d. {radio, checkbox, select}

PART II – Short Answer Type Questions (20 Marks)

Answer ALL the questions. Each question carries 5 marks. Mark for each sub-question is indicated in the brackets.

1. If a dice is rolled and a coin is tossed, answer the following questions:

- a. Provide the sample space of the above event *(1 mark)*
- b. What is the probability that the dice shows odd number and the coin shows head? *(2 marks)*
- c. Now only a coin is tossed three times but it is biased to get 75% head. What is the probability of getting one head and two tails in any order? *(2 marks)*

2. Study the table and answer the following questions:

The table below shows the record of contract employees recruited by RCSC and provided with unique employee ID to each recruit.

Employee ID	Contract No	Duration	Employee Name	Agency ID	Agency Location
201501080	C001025	72 months	Karma	10101	Paro
201501081	C001025	48 months	Dorji	10101	Paro
201508100	C001027	24 months	Dechen	20101	Thimphu
201408101	C001027	24 months	Karma	20101	Thimphu

- a. In which normal form is the given table? *($\frac{1}{2}$ mark)*
- b. Find the primary key for the relation and explain your choice. *(1 mark)*
- c. Find fully functional dependencies on the PK and Partial Dependencies on the PK *($1\frac{1}{2}$ marks)*
- d. Normalize the table to 2NF. *(2 marks)*

3. In data mining:

a. What is snowflake schema? (2 marks)

b. What is the difference between data warehousing and business intelligence? (3 marks)

4. Using java, complete the following skeleton code with dotted lines for Exception Handling using *throw*, *try* and *catch* keywords. Assume header and main class files are included. (5 marks)

//The method *Division* takes two integers *and* divides first integer by second integer, and throws exception if divided by zero.

```
public static double Division (.....)
{
    .....
}
```

//The main function handles the exception without runtime error

```
public static void main(String [] args)
{
    int a = 20, b = 0;
    double result;

    try{
        .....
    }catch(.....){
        .....
    }
}
```

SECTION B

Case Study

Choose either case 1 or Case 2 from this section. Each Case carries 50 marks. Mark for each sub-question is indicated in the brackets.

CASE 1:

The Business Association of Bhutan has recently approached you to help develop a simple e-commerce application called **BhutanOnlineShopping**. The system may be developed using open source or proprietary technologies. The requirements provided by the manager of the system are not clear and many changes are expected during the course of system development. To be more adaptive, you decide to use Agile methodology to develop the

system.

The database of the system must minimally capture the following information:

- Customer information has *customer name, customer number, contact number, address and payment detail*. The payment detail includes *credit card types, card number, expiry date and bank name*.
- Product information has *product ID, name, description and brand*.
- Stock information has *product ID, quantity and unit price*.

The customers can visit the BhutanOnlineShopping site and browse the available products. If they find particular product of their interest, an order is placed for the products. The purchase order detail has *order number, order date, invoice number* and other relevant information to sufficiently identify specific orders. The products of confirmed purchases are shipped to the customer.

Based on above-mentioned information, answer the following questions:

1. Briefly explain the agile software development methodology. (5 marks)
2. Provide conceptual design of the database of the system using E-R model. Include all the entities, attributes and relationships. (10 marks)
3. Based on your E-R model:
 - a. Use DDL to create ***Order*** table with all the necessary constraints. (5 marks)
 - b. The manager of the BhtuanOnlineShopping wants to look at a specific purchase order with order No = 1200 for a customer with order detail and total price. Using standard SQL language, write a query to display the required information. (10 marks)
4. For any web application like BhutanOnlineShopping, if you don't consider non-functional requirements, the solution could be rendered useless.
 - a. What do you understand by non-functional requirements of a system? (1 mark)
 - b. As a web application developer, the measures must be taken to prevent common web application security threats during the phase of development. Mention any 3 common web security threats and their preventive measures. (6 marks)
 - c. Briefly explain any other 3 important non-functional requirements for BhutanOnlineShopping besides the security requirement. (3 marks)

5. For BhutanOnlineShopping, many different types of users and data flows are expected. Based of DFD design concept, what is a Context Diagram? Provide a simple Context Diagram for above system and state any assumptions you have made. (5 marks)
6. The user interface (UI) design is one of the important design works in application development. There are many fundamentals/principles to keep in mind while designing UIs. Provide any 5 principles of UI design. (5 marks)

CASE 2:

A new bank located its headquarter in Thimphu has 4 branch offices in 4 different dzongkhags. The bank provides the following centralized services:

- Self-inquiry Facility: Facility to log into specified self-inquiry terminals at the branch to inquire and view the transactions in the account.
- Anytime and Anywhere Banking: ATMs, which offer non-stop cash withdrawal, remittances and inquiry facilities from any of the branches.
- Telebanking: A 24-hour phone service to inquire information related to balances and transactions in the account.
- Electronic Banking: Online services for customers to inquire about their financial transactions, transfer cash and request chequebook without visiting the bank.

1. Based on the above scenario:
 - a. What are the three typical WAN topologies that can be used to connect headquarter and 4 branch offices? (3 marks)
 - b. What are the advantages and disadvantages of each topology? (6 marks)
 - c. What is an advantage of providing centralized services? (1 mark)
2. The services provided by the bank are hierarchical structure in nature and the amount of data exchanged between the branch offices is negligible or non-existent. It is recommended to deploy VPNs based on Layer 2 technologies such as frame relay or ATM to reduce cost and routing complexity. It is also recommended to implement redundancy in the headquarter office.
 - a. Explain your physical network topology with diagram? (10 marks)
 - b. What are the disadvantages of implementing redundancy at the headquarter office? (5 marks)
3. Assuming you are working as a Network administrator for the Bank:

- a. What are the potential security threats do you foresee for the above services?
(5 marks)
 - b. Explain each of the threats with possible solutions to mitigate or prevent the threats?
(10 marks)
4. A security policy document is a “*living document*” that states how to protect the company’s physical and information technology assets. The core of a security program is all about risk management.
- a. What do you understand by “*living document*”? (1 mark)
 - b. What is risk management? (2 marks)
 - c. What are the basic steps of risk management? (7 marks)

