

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

PAPER III: SUBJECT SPECIALIZATION PAPER for *IT 3 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 11 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. Which of the following network devices sends data packets only to receiving device?

- a. Hub
- b. Switch
- c. Bridge
- d. Repeater

2. EPIC in computer architecture means:

- a. Explicitly Parallel Instruction Computing
- b. Explicitly Programmed Instruction Computing
- c. Explicitly Parsed Instruction Computing
- d. Explicitly Protected Instruction Computing

3. DNS is -----

- a. The distributed hierarchical naming system
- b. The horizontal naming system
- c. The vertical naming system
- d. The client server system

4. Which layer of the TCP/IP model includes protocols such as ICMP and ARP?

- a. Application Layer
- b. Transport Layer
- c. Internet Layer
- d. Network Access Layer

5. In c programming language, *continue* statement is used to:

- a. Come out of a loop
- b. Exit and return to the main function
- c. Restarts iteration from beginning of a loop
- d. Go to the next iteration in a loop

6. C++ exception handling mechanism mainly uses how many keywords?
- a. Four
 - b. Three
 - c. Two
 - d. One
7. A microprogram written as string of 0's and 1's is a:
- a. Symbolic microinstruction
 - b. Binary microinstruction
 - c. Symbolic microinstruction
 - d. Binary micro-program
8. Only authorized parties can modify the computer system assets. In computer security, which of the following term is related to the above definition?
- a. Confidentiality
 - b. Integrity
 - c. Availability
 - d. Authenticity
9. Arrays are best data structure for:
- a. The relatively permanent collections of data
 - b. The data whose size and structure are constantly changing
 - c. Both of above
 - d. None of the above
10. Which of the following improves a query's processing time?
- a. Write complex queries
 - b. Combine a table within itself
 - c. Use compatible data types
 - d. Query one query within another

11. A function is said to be -----, if and only if $f(a) = f(b)$ implies that $a = b$ for all a and b in the domain of f .

- a. One-to-one
- b. One-to-many
- c. Many-to-many
- d. Many-to-one

12. Which of the following is used to provide integrity check, authentication and encryption to IP datagram?

- a. Secure Socket Layer
- b. Encapsulating Security Payload
- c. Transport Layer Security
- d. All of the above

13. In the following java code, what is the output produced?

```
//Code Segment  
public class StaticMethod {  
    static int a=0;  
    static int b=++a;  
    static int c=++a;  
  
    public static void main(String[] args) {  
        System.out.print(a+" "+b+" "+c);  
    }  
}
```

- a. 0 1 1
- b. 1 1 2
- c. 1 2 3
- d. 2 1 2

14. Data Transfer between the Main memory and the CPU register takes place through two registers namely:

- a. MAR and MDR
- b. General purpose register and MDR
- c. Accumulator and program counter
- d. MAR and Accumulator

15. Select the correct layout corresponding to the following HTML code segment: (*The code is not indented*)

```
<ol type="A"> <li>Dzongkhag</li>
<ol type="a"> <li> Thimphu </li> </ol>
<li> Agency </li>
<ol> <li> RCSC </li> </ol>
</ol>
```

- a.

A. Dzongkhag
a. Thimphu
B. Agency
1. RCSC
- c.

A. Dzongkhag
1. Thimphu
B. Agency
a. RCSC
- b.

A. Dzongkhag
a. Thimphu
B. Agency
a. RCSC
- d.

A. Dzongkhag
a. Thimphu
B. Agency
b. RCSC

16. What is the correct syntax to be used to insert a Javascript into an HTML page?

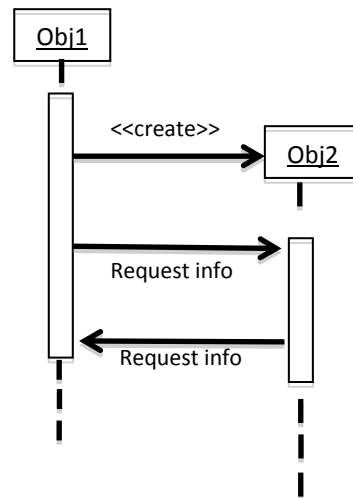
- a. <script type = "text/javascript">
- b. <type script = "text/javascript">
- c. <scripting = "text/javascript">
- d. <scripting language = "text/javascript">

17. The output of Boolean expression is: $F(X,Y) = \overline{(\overline{X} \cdot \overline{Y})} \cdot \overline{(X + Y)}$

- a. X
- b. Y
- c. 0
- d. 1

18. Adjacent UML diagram is an example of:

- a. State Diagram
- b. Sequence Diagram
- c. Class Diagram
- d. Dataflow diagram



19. Which of the following is/are the functions of operating system?

- A - Scheduling resources among users
 - B - Allowing users to share data among themselves
 - C - Recovering from errors
 - D - Preventing users from interfering with one another
-
- a. A, B and C only
 - b. A, B and D only
 - c. B, C and D only
 - d. All of the above

20. Which layers of the OSI model connect with networking?

- a. Network layer and Application layer
- b. Transport layer and Network layer
- c. Data link layer and Physical layer
- d. Data link layer and Session layer

21. Which of the following is(are) method(s) of implementing the system?

- a. Parallel running
- b. Direct changeover
- c. Pilot running
- d. All of the above

22. The hexadecimal equivalent of the octal number 75 is:
- a. 3D
 - b. 2B
 - c. 1C
 - d. 4A
23. Which of the following allows definitions and query language statements to be entered; query results are formatted and displayed:
- a. Schema processor
 - b. Query Processor
 - c. Terminal Interface
 - d. None of the above
24. What is the technology used in third generation computers?
- a. Micro processors
 - b. Transistors
 - c. Integrated circuits
 - d. Vacuum tubes
25. Reliability in a software system can be achieved using which of the following strategies.
- a. Fault avoidance
 - b. Fault tolerance
 - c. Fault detection
 - d. All the above
26. The XML format has a simpler set of than HTML.
- a. Loader rule
 - b. Parsing rules
 - c. Generator rules
 - d. Logical rules
27. The inputs/outputs of an analog multiplexer/demultiplexer are:
- a. Bidirectional

- b. Unidirectional
- c. Even parity
- d. Binary-coded decimal

28. Which of the following are the three basic sections of a microprocessor unit?

- a. Operand, Register and Arithmetic/logic unit (ALU)
- b. Control & timing, Register and Arithmetic/logic unit (ALU)
- c. Control & timing, Register and Memory
- d. Arithmetic/logic unit (ALU), Memory and Input/Output

29. A multimedia presentation can be:

- A - Linear
- B - Nonlinear
- C - Structured Link
- D - Web page

- a. A and B only
- b. C and D only
- c. A, B and C only
- d. All of the above

30. Which software is not correctly associated with its usage?

- a. Desktop publisher = Producing a school magazine
- b. Spreadsheet = Managing personal finance
- c. Database = Storing student records in a school
- d. Outlook = Filing office documents

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. In application development process:

- a. What is system analysis? *(1 mark)*
- b. Give four methods of analysing the existing system. *(4 marks)*

2. In file systems:
 - a. What does FAT32 and NTFS stands for? (2 marks)
 - b. Provide at least 3 differences between FAT32 and NTFS file systems? (3 marks)

3. What are the reasons for shifting towards digital transmission despite having large analog base? (5 marks)

4. Simplify and Draw the logic circuits for the given Boolean expression: (5 marks)

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

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:

Royal University of Bhutan (RUB) plans to introduce common grading and assessment system for all the colleges under them, so that there are uniform grading systems focused on wholesome education. To implement the new grading system, the RUB wants to develop an Assessment System (AS). To keep the system simple, the first version of AS will capture the following information:

- The database will keep track of and display student grades/marks for several courses.
- The course is identified by course ID, department, course title, semester and year.
- For each course, the grade is determined by marks of various assessment categories such as exams, quizzes, homework, labs, projects and fieldworks. The percentage of all the categories should add up to 100%. The marks distribution and type of assessments depend on type of courses enrolled by the student.
- Each assessment will have marks obtained by each student, category of assessment, percent distribution and instance. The instance is to help identify which quiz, exams, projects, etc. like quiz 1, quiz 2, project 1, project 2 and so on.
- The lecturer can add courses and list students enrolled for the courses. The student detail include student name, student number and major of each student
- The lecturer can change the distribution of marks, add and delete any assessment categories and update grades/marks of each student.

- The system should compute the average grades for each assessment, the current percentage score of each student, and also be able to sort the students by name, total percentages or by each assessment category.

To design the above system, answer the following questions:

1. After going through the given requirements, explain:
 - a. What do you understand by an Entity in E-R model? What is the difference between weak entity and strong entity? (2 marks)
 - b. List down all key entities of Assessment System and identify whether it is weak or strong entity (1 mark)
 - c. Provide an example of table schema of a weak entity and a strong entity that is related. (2 marks)
2. Draw a complete entity-relationship diagram with attributes, relationships and primary keys to reflect above database design. Some entities may require adding your own primary keys. (10 marks)
3. In your E-R Model:
 - a. Which entities have many-many relationships? With an example, explain how do you implement such relationship in database design? (5 marks)
 - b. In any database design, what is the purpose of implementing constraints? With example, briefly explain the use of constraints. (5 marks)
 - c. Using standard SQL language, create *Student* and *Courses* tables and any other intermediary table required to define relationship between *students* and *courses*. Mention all constraints requirement including primary and foreign keys. (10 marks)
4. In the context of RDBMS:
 - a. What do you understand by referential integrity? (2 marks)
 - b. With an example, explain *Cascading delete* and *cascading update*. (2 marks)
 - c. What are some of the data quality requirements in developing a database? Briefly mention any 3 data quality requirements. (3 marks)

- d. Explain briefly the technologies and tools you would use to develop above Assessment System. (3 marks)

5. For a system, what are the differences between functional and non-functional requirements? (5 marks)

CASE 2:

The ministry of foreign and external affairs is a newly established ministry with more than 150 employees. The ministry has four departments: Department of Passport and Visa, Department of Human Resources, Department of Finance and Department of Bilateral Affairs.

The ministry is planning to build a secure and robust Network to host the following services.

- Online passport and visa application system for general public
- Ministry's website to disseminate announcements to public
- Secure email services for all the employees in the ministry and embassies/consulates
- Personal information system that is accessible only by the department of Human resources.
- Payroll system that is accessible only by the department of finance.

You are recruited as a network administrator of the ministry and assigned the task to design and manage the network of the ministry.

1. Draw a physical network diagram of the ministry and briefly explain your network design? (10 Marks)
2. a. What do you understand by structured and unstructured security threats? (3 Marks)
b. Explain four countermeasures to prevent external threats and four countermeasures to prevent internal security threats? (12 Marks)
3. a. What is Internet Protocol (IP)? (1 Mark)
b. Give four reasons why IPv6 is better than IPv4? (4 Marks)
4. Describe the process of hosting website www.ministry.gov.com in your network? (5 Marks)
5. a. Provide five differences between TCP/IP and OSI model? (5 Marks)
b. Explain functions of Network layer in OSI model? (5 Marks)
6. a. What are the two types of Internet Protocol (IP) traffic? (2 Marks)
b. What type of Internet protocol traffic is used for online games and why? (3 Marks)