

ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2011
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION for ICT(3 YEARS) GROUP

Date	:	October 30, 2011
Total Marks	:	100
Duration	:	2 ½ Hours
Reading Time	:	15 Minutes(Prior to commencement of writing)

INSTRUCTIONS

- 1) This paper consists of **9** pages. Ensure that you have all of them.
- 2) This paper consists of two sections, Section A of 50 marks and Section B of 50 marks.
- 3) Section A contains two parts. Part I consists of 30 multiple choice questions of 1 mark each with a total of 30 marks. Part II consists of 4 short answer questions of 5 marks each with a total of 20 marks. You are required to attempt all questions in this section.
- 4) Section B contains two case studies of 50 marks each. You are required to attempt only one of them. If both have been attempted, only the first will be marked.
- 5) If any question or part of a question is not clear, make reasonable assumptions and attempt the question. Clearly state your assumption in the answer sheet.
- 6) All answers must be written in separate answer sheets provided. Answers written on question papers will not be accepted.

SECTION A (50 Marks) Part I (30 x 1=30)

- 1) Which of the following is the correct order of layers in OSI model
 - a) Application, Presentation, Session, Transport, Network, Data Link Layer, Physical
 - b) Physical, Transport, Data Link Layer, Presentation, Application, Internet
 - c) Presentation, Session, Transport, Physical, Application, UDP, Network
 - d) Sockets Layer, Internet Layer, Communications Layer, Application Layer
- 2) _____ Layer has Media Access Control Layer (MAC) and Link Control Layer (LCC) sub layers
 - a) Presentation
 - b) Transport
 - c) Data Link
 - d) Internet
- 3) Transmission Control Protocol of the Internet Protocol Suite is a
 - a) Data encryption standard
 - b) Connection oriented protocol
 - c) Connection less protocol
 - d) None of the above
- 4) UDP can be used for all of the below EXCEPT
 - a) Voice over IP
 - b) Video conference
 - c) Viewing someone in a Webcam over the Internet
 - d) Updating a staff profile over the Internet to a backend database
- 5) 10.10.1.2 is a _____ private IP Address
 - a) Class E
 - b) Class D
 - c) Class A
 - d) Class B
- 6) Which of the following is NOT true about the Water Fall model of Software Engineering
 - a) Completeness criteria of every SDLC stage is clearly defined
 - b) Discourages revisiting and revising any prior phase once it's complete
 - c) Not a flexible model
 - d) It is an iterative model
- 7) "Implementation" is the SDLC phase during which
 - a) The software development work is presented to the company boss
 - b) Software is tested for defects
 - c) Software engineers program the software
 - d) Software gets used by end users
- 8) Software Requirements Specification (SRS) is an artifact produced to document
 - a) Software Deployment
 - b) Implementation and Coding
 - c) Requirements Analysis
 - d) User Acceptance Testing

- 9) Which of the following is NOT true about white box testing
- Tests internal workings of an application
 - Can be used in unit testing to test paths within a unit
 - Can uncover all missing requirements
 - Tests all conditional statements in a function
- 10) Regression testing for a software is done to
- ensure that a change in the program, after fixing a bug, did not result in any new bugs
 - ensure that the software development is completed on time
 - find out stress threshold of the software
 - None of the above
- 11) Object Oriented Programming is a
- High level programming language
 - Low level programming language
 - A programming paradigm that simulates real life scenario
 - Procedural programming language
- 12) An object in C++ programming language is
- a control structure
 - a data type
 - an instance of a defined class
 - an aggregate function
- 13) The following code snippet is a case of
- Polymorphism
 - Inheritance
 - Early binding
 - None of the above

```
Public class Car{ }
Public class Alto: Car{ }
```

- 14) The following code snippet is a case of
- Method overloading
 - Method overriding
 - Operator overloading
 - Inheritance

```
Public class ErrorLog {
Public void DisplayError(Exception e){ }
Public bool DisplayError(Exception e,string errorMessage){ }
}
```

- 15) Data Definition Language (DDL) does all of the following **EXCEPT**
- Create tables, files, databases and data dictionaries
 - Define integrity constraints on various tables
 - Define security and authorization information of each table.
 - Retrieve information from the database

- 16) When every non- key column of a relation in a relational database is non transitively and fully dependent upon its primary key, the relation is said to be in
- Boyce Coded normal form
 - 1NF
 - 3NF
 - None of the above
- 17) In entity relationship modeling an entity is called a **weak entity** when
- It does not have a super key
 - It does not have a primary key
 - It does not have a candidate key
 - All of the above
- 18) The following are all Relational Database Management Solutions EXCEPT
- Oracle Express Edition
 - MS SQL Server 2008
 - MySql
 - ASP.Net
- 19) _____ JOIN in a SQL query would output **ONLY** matching records from its input tables in the resultant table after execution
- Left outer join
 - Right outer join
 - Inner join
 - Circular join
- 20) XML stands for
- External mail language
 - Extensible markup language
 - Exactly marked language
 - External markup link
- 21) A server on a local Area network that caches web pages, filters web traffic and relays request to external web services on behalf of client systems is called a
- Web server
 - Back up server
 - Database server
 - Proxy server
- 22) _____ is a new way of IT service delivery whereby shared hardware and software resources are made available as services on the Internet providing access to advanced software applications and high-end networks of server computers.(Hint: Amazon EC2 and Google Apps)
- Joint computing
 - Cloud computing
 - Sun computing
 - All of the above

- 23) MVC architecture in system development stands for
- a) Minimum View Control
 - b) Model View Controller
 - c) Middle View Component
 - d) None of the above
- 24) HTTP is an example of a layer_____ protocol
- a) 2
 - b) 4
 - c) 5
 - d) 7
- 25) Default port no for Simple Mail Transfer Protocol is
- a) 110
 - b) 2030
 - c) 450
 - d) 25
- 26) Tracert is a network troubleshooting command to
- a) See if a remote host is up or not
 - b) Check the IP address of a remote host
 - c) Check the number of hops a packet takes to get to a specified destination
 - d) Find out DNS resource records
- 27) Where does the control unit look in order to find the address of the next instruction to be fetched?
- a) Memory Address Register(MAR)
 - b) Instruction Register(IR)
 - c) Memory Buffer Register(MBR)
 - d) Accumulator(ACC)
- 28) The output will be a LOW for any case when one or more inputs are zero in
- a) OR Gate
 - b) NAND Gate
 - c) XOR Gate
 - d) AND Gate
- 29) Which header file should be included to use functions like *malloc()* and *calloc()*?
- a) <stdlib.h>
 - b) <stdio.h>
 - c) <malloc.h>
 - d) <math.h>
- 30) How many times the word "happy" gets printed in the following c program?
- a) Infinite
 - b) 4
 - c) 0
 - d) 11

```
#include<stdio.h>
int main()
{
```

```

int x;
for(x=-1; x<=10; x++)
{
    if(x < 5)
        continue;
    else
        break;
    printf("happy");
}
return 0;
}

```

Part II (4x5=20)

- 1) What is a web service? Explain the use of web services with the help of an example.
(5 marks)
- 2) What is a stored procedure in a database? Referring the following tables, write a stored procedure that accepts CID as a parameter and lists the names of employees with sum of payment made in for year 2001.
(5marks)

Employee			
CID	Name	Age	Gender
001	Dorji	23	Male
002	Pema	25	Female
003	Dorji	56	male

Payment		
CID	Payment	Date
001	2000	01/02/2001
001	2000	01/03/2001
002	3000	01/02/2001
002	3000	01/03/2001
001	2000	01/02/2009
002	2000	01/02/2008

- 3) What do you mean by three-tier architecture in web application development? Explain it with the help of a diagram.(5 marks)
- 4) What are basic stages in a software development life cycle? Explain each of them briefly. Name a few software development models.(5 marks)

SECTION B (50 Marks)

There are two case studies in this section. You are required to choose and attempt only one of them.

Case I

ChogJur University is a highly reputed medium sized university of about 10.000 students. The following describes how the university manages its courses. The university offers its courses on a semester system.

The university keeps track of each student's name, student number, citizenship identity number, current address , phone number, permanent address, date of birth, sex, class (newcomer, old), major department, minor department (if any), degree program (B.A. B.S., BTech.Ph.D.). Some other applications of the university need to refer to the dzongkhag, gewog and village of the student's permanent address and to the student's last name. Both citizenship identity number and student number are unique for each student. All students will have at least a major department.

Each department is described by a name, department code, office number and office phone. Both the name and code have unique values for each department.

Each course has a course name, description, course number, number of credits, offering department. The course number is unique for each course. Courses are broken into different sections.

Each section has an instructor, semester, year, course, and section number. The section number distinguishes sections of the same course that are taught during the same semester; its value is an integer (1, 2, 3, ... up to the number of sections taught during each semester).

A grade report must be generated for each student that lists the section, letter grade, and numeric grade (0,1,2,3, or 4) for each student and calculates his or her average GPA.

The university plans to develop an online registration system so that overseas students can register online for different courses offered by the departments of the university. However the university is wary of potential security threats to the database server and does not intend to make the server directly accessible to users over the Internet.

Questions

1. What is an Entity Relationship Diagram? Design an Entity Relationship diagram for the above case. Your E-R model must capture all aspects of the given case such as attributes of entities, relationships and their cardinalities, multi-valued attributes, derived attributes, etc. (10 Marks)

2. What does it mean when a database is said to be in third normal form? Based on your E-R model design table schema with appropriate data types for the columns identified. Your table design must be in third normal form.(10 Marks)

3. (a)What do you mean by data definition language in SQL? Write down SQL statements to create any two tables identified in Question no 2.(5 Marks)

(b)What is a weak entity? Is there any weak entity in your E-R model? (5 Marks)

4. What do you mean by referential integrity constraint in database management systems? What are some advantages of enforcing referential integrity constraints in a database implementation? Explain how referential integrity constraint can be applied in the above case.(10 Marks)

5. (a)What RDBMS solution will you use to implement the **Chogjur** university database, and why? Explain how you will design the system for the online course registration functionality. Mention the software tools you will use to develop the online course registration functionality. (5 Marks)

(b)How can you share the university database information on the online registration page without exposing the physical database server on the Internet? Explain with the help of a diagram.

(5 Marks)

Case II

Ministry X is a newly established fairly large ministry with 100 plus employees at the headquarters in the capital city and 250 more employees in the districts. The ministry has the following five Departments; Department of Human Resources, Department of Finance, Department of Planning, Department of Revenue Collection and Management and Services Department.

The ministry is housed in a newly built large building. The ministry plans to establish a strong IT infrastructure. The capital city has a high speed fiber optic Wide Area Network (WAN) backbone that connects all the other government agencies and corporations. Ministry X will also be connected to the WAN. A local area network (LAN) will be set up with high speed dedicated Internet connection.

Department of Finance, Revenue Generation and Human Resources will have their own Information Management Systems bought off the shelf from third party vendors. These systems have to be hosted on the Ministry LAN for secure access by registered users (employees of the ministry) stationed in the Districts.

Budget proposals from district offices will go to Department of Finance, and Revenue collection information will be updated into the information System of Department of Revenue Collection.

Therefore these two systems require secure connectivity from the district offices. The Human Resource Department System will only be used by HR personnel in the ministry at the head quarters.

The ministry will also have a website hosted to share information with the public which need not have secure connectivity. All the employees both in the ministry and the districts will have email address with the ministry domain.

The ministry also wants to maintain a redundancy failover system outside of the ministry building.

You have been recruited as the IT manager of Ministry X and assigned the task to develop a clear and concise proposal to establish the ICT infrastructure of the Ministry fulfilling the given requirements.

Questions

1. List all the network equipments, servers, power supply requirements, other required items from ISP like domain name registration, etc that may be required in setting up the LAN that will incur cost to the ministry. Also, describe the utility of the network equipments.(10 marks)
2. Draw a layout of the local area network, with clear labels, that exhaustively captures the specified requirements of the ministry. The ministry will also be connected to the City Wide Area Network(WAN). What is a WAN? Do we have WAN setup in Bhutan? (10 marks)
3. The ministry will have about 100 plus computers on the LAN. What Class of IP addressing scheme would you use, and why? On your network layout diagram assign the servers and other network equipments with appropriate IP addresses. Name the protocol used in automatically assigning IP addresses to systems on a local area network? (10 marks)
4. While the ministry website could be hosted for the general public, two other systems need secure access. Provide options of connecting the district offices to the ministry headquarters securely? Explain your options with the help of diagrams. (10 marks)
5. The Transmission Control Protocol (TCP) is responsible for reliable transmission of information using a connection-oriented service. Explain how TCP achieves this. (10 marks)

-----Thank You-----