ROYAL CIVIL SERVICE COMMISSION
BHUTAN CIVIL SERVICE EXAMINATION (BCSE) 2010
EXAMINATION CATEGORY: TECHNICAL

PAPER III: SUBJECT SPECIALIZATION for ICT (4 YEARS) GROUP

Date	:	November 24, 2010
Total Marks	:	100
Duration	:	$2\frac{1}{2}$ 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 2 Sections, Section A of 50 marks and Section B of 50 marks.

3. Section A contains two parts. Part A consists of 30 multiple choice questions of 1 mark each with a total of 30 marks. Part B 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. Assumptions must be clearly stated 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)

For each question choose the right response. On the answer sheet write the question number and the choice number eg:- 1) b   if you think that b is the right choice for question 1.

1) How many broadcast domains are created when you segment a network with 12- port switch?

    (a) 1   (b) 2   (c) 5   (d) 12

2) What type of Network Address Translation can be used to have one IP address allow many users to connect to the global Internet?

    (a) NAT   (b) Static   (c) Dynamic   (d) PAT

3) Which protocol does DHCP use at the transport layer?

    (a) IP   (b) UDP   (c) TCP   (d) ARP

4) When data is encapsulated, which is the correct order?
    (a) data, frame, packet, segment, bit
    (b) segment, data, packet, frame, bit
    (c) data, segment, packet, frame, bit
    (d) data, segment, frame, packet, bit

5) What is the maximum number of IP addresses that can be assigned to hosts on a local subnet that uses the 255.255.255.224 subnet mask?
    (a) 14   (b) 30   (c) 16   (d) 62

6) If you need to use a cable that is not affected by EMI then your choice should be:
    (a) UTP   (b) Coaxial cable   (c) cat 5 UTP   (d) fiber optic

7) Which subset of Structured Query Language is used to create and modify a database schema?
    (a) Data definition language   (b) data structure language   (c) database schema language
    (d) database manipulation language

8) Well known ports range from
    (a) 1-256
    (b) 1-1024
    (c) 7-999
    (d) 80-125

9) Binary search requires that the list be searched is_____.
    (a) random   (b) vector   (c) ordered   (d) none of above

10) The _____ determines whether the project should go forward.
  (a) Feasibility assessment
  (b) Opportunity identification
  (c) System evaluation
  (d) Program specification

11) What is the maximum data rate for the 802.11g wireless standard?
  (a) 6 mbps   (b) 11 mbps   (c) 22 mbps   (d) 54 mbps

12) Which of the following is a correct *association* of a use case diagram?
  (a) Extend   (b) exclude   (c) except   (d) between

13) Coupling in OOP means _____.
  (a) The measure of likeness among the elements of a module
  (b) The measure of strength of association between modules
  (c) The measure of complexity of algorithm used in the module
  (d) None of the above

14) Simple Object Access Protocol is a specification for exchanging structured information in
  a) Unix
  b) Web Services
  c) C++
  d) None of the Above

15) • NET framework is an example of a _____.
  (a) Operating System
  (b) Programming Language
  (c) Software development environment
  (d) Is all of above

16) The actions in a Java class are called _____.
  (a) Procedures   (b) functions   (c) methods   (d) subroutines

17) What is an overloaded constructor?
  (a) constructor with too many program statements.
  (b) A second constructor with the same constructor heading as the first constructor.
  (c) Second constructor with a different identifier than the first constructor.
  (d) A second or other multiple constructor with a different signature than any other constructor.

18) When none of the attributes in a database relation have partial dependence on its concatenated key the relation is said to be in _____.

  (a)   1 NF   (b) 2 NF   (c) BCNF   (d) Platform independent

19) A class, which can use all the features of an established class, is
  - (a) a static class.
  - (b) a superclass.
  - (c) a subclass.
  - (d) overloaded.

20) DNS query uses the following protocol and port combination.
  - (a) TCP and port 53
  - (b) UDP and port 125
  - (c) Http and port 80
  - (d) UDP and port 53

21) The Boolean expression A >= B is equivalent to which of the following expressions?
  - (a) not (A > B)
  - (b) not (B >= A)
  - (c) not (A < B)
  - (d) A != B

22) The do..while loop is ideal for loop structures that

  - (a) repeat some process a fixed number of times.
  - (b) must execute some process at least one time.
  - (c) must check the loop condition before the loop body is executed.
  - (d) do all of the above.

23) When the encryption key cannot be calculated from the decryption key and vice versa in a reasonable amount of time the cryptography algorithm used is _____.

  - (a) Symmetric
  - (b) Asymmetric
  - (c) Asymptotic
  - (d) All of the above

24) What is the primary purpose of an **Iterator** object?
  - (a) To add new objects to a collection.
  - (b) To step through the objects of a collection one at a time.
  - (c) To play an audio clip.
  - (d) To display a graphical object.

25) Consider this binary search tree:

```
        14
       /  \
      2    16
     / \
    1   5
       /
      4
```
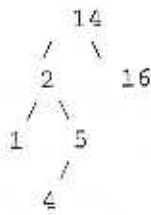
Suppose we remove the root, replacing it with something from the left subtree. What will be the new root?

(a) 1
(b) 2
(c) 4
(d) 16

26) Selection sort and quick sort both fall into the same category of sorting algorithms. What is this category?

(a) O(n log n) sorts
(b) Divide-and-conquer sorts
(c) Interchange sorts
(d) Average time is quadratic.

27) What is the primary purpose of template functions?

(a) To allow a single function to be used with varying types of arguments
(b) To hide the name of the function from the linker (preventing duplicate symbols)
(c) To implement container classes
(d) To permit the use of the debugger without the -gstabs flag

28) Which of the following statements is NOT true

(a) Coding standards address naming of constants.
(b) Coding standards address the number of errors encountered per 1000 lines of code.
(c) Coding standards address layout of code text.
(d) Coding standards address the use of program comments.

29) Which form of software development model is most suited to a system where all the requirements are known at the start of a project and remain stable throughout the project

(a) Waterfall model
(b) Incremental model
(c) Evolutionary model
(d) Spiral model

30) The feature in a programming language to reclaim an unreachable memory after it had been dynamically allocated is called

(a) Memory Leak
(b) Garbage Collection
(c) Dynamic memory allocation
(d) Machine independence

Part II (4x5 = 20)

1) What is a web service? Explain its use in today's world of increased interactions between different IT systems.

2) Write a C program to produce a multiplication table. The program must get an integer input and output its multiplication table from 1 to 12. The program should check for valid input from the user. If the input is not an integer but something else like a character, then it should provide an appropriate message and get the input again. If the input is zero, the program doesn't do anything but outputs a message "Any number multiplied by zero is a zero". Below is an example of how an output should look (when the user inputs integer number 9)

   9 x 1 = 9

   9 x 2 = 18

   9 x 3 = 27

   9 x 4 = 36

   9 x 5 = 45

   9 x 6 = 54

   9 x 7 = 63

   9 x 8 = 72

   9 x 9 = 81

   9 x 10 = 90

   9 x 11 = 99

   9 x 12 = 108

3) Write a C function that implements a queue as a linked list.

4) Name any 4 UML diagrams and explain their use.

SECTION B (50 marks)

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

Case 1

Tiger Bank is a private bank that has just been licensed to start operations in a country called Tigerville. It plans to provide all kinds of banking and financial services such as deposits, loans, project-based financing, credit card facilities etc. It will be headquartered in the capital city in a big building. The head quarter will have five departments: finance, operations, human resources, policy and planning, and administration, all housed in the same building. The bank has identified branches throughout the big country, one in each of the 50 districts and each with about 100 people. The head office has about 2000 people.

When in operation it would have an enterprise banking software, a corporate website and other operations related systems. All these systems will be housed with the head office.

You have been called in as an ICT expert to get their network infrastructure and others ICT aspects in place, both in individual offices and for the entire bank.

Questions

1) Provide network design solutions to each individual offices, i.e. one for the head quarter and a generic one for the branch since all branches are similar in nature. (10 marks)

2) At the headquarter, since the different departments would handle different aspects of the business with different levels of confidentiality in the information, the management (which has already been constituted) has decided that it might not be a good idea to keep them all on a single network. What nifty solution would you recommend? Explain some additional benefits that your solution provides other than handling sensitive data? (10 marks)

3) Explain to the management the different options that are available for them to connect the head quarter to the branch offices. Recommend one of them with good reasons. (10 marks)

4) Based on your recommendations the management has decided to establish the network and place the software systems. Recommend:

a) an appropriate organizational setup to manage the ICT systems in the bank at all levels (5 marks)

b) The different kinds of people required to manage the ICT systems, and their responsibilities (5 marks)

5) During you involvement with the bank, a fresh IT graduate has been recruited as a trainee with the potential to recruit if she is found good. Explain to her what these terms mean in networking. (2 x 5 =10 marks)

       (a) The command nslookup

       (b) Spanning tree protocol

       (c) Private IP addresses

       (d) Checksum

       (e) Classless routing

Case 2

Khephen Company deals in hardware trading. The company supplies different hardware items depending on orders received from customers.

Invoices are sent to customers for clearing payment after supplying the items in the order to the customers.

The company currently manages the information in a spreadsheet. A sample of the spreadsheet is shown below.

Invoice no	Date	Customer name	Customer Address	Item ID	Item Description	Item Quantity	Item Price	Total Item Price	Total Order Price
125	2/3/2010	Tashi	Changangkha	T400	Laptop	1	Nu.40,000	Nu. 40,000	Nu. 44,100
				A89	Adaptor	4	Nu. 400	Nu. 1600	Nu. 44,100
				U21	USB Drive	5	Nu. 500	Nu 2500	Nu. 44,100
126	5/4/2010	Pema	Motithang	PC755	Dell Desktop	1	Nu. 25,000	Nu. 25,000	Nu. 75,000
				M25	Mobile Phone	5	Nu. 10,000	Nu. 50,000	Nu. 75,000

The company has realized that the current approach of information management will not be sustainable and efficient as the spreadsheet becomes larger. The company has decided to use a software solution that supports Relational Database Management capability.

The company also felt the need to provide an online order collection site which would be accessible to any customer who has Internet connection. The feature would directly interact with the company's newly planned relational database and update related database tables for further processing of the order.

Based on the case given above provide clear and concise solutions to the following questions.

Questions

1) Provide an E-R model of the new solution as the company switches operation from spreadsheet to RDBMS. In the E-R model clearly identify all the attributes, relationships and their cardinalities. (10 marks)

2) From your E-R model construct the relational database tables. Your final database tables construct must be in Third Normal Form. Clearly explain how the final table structures fulfill Third Normal Form requirement.(10 Marks)

3) As far as possible you are required to limit accessing the database tables directly especially while generating reports. One of the reports generated is a list of customer with customer details who made orders between 01/01/2009 and 01/03/2009. How would you generate this report limiting access to the base tables? Write down SQL statements for generating this report. (10 Marks)

4) Upon receiving the orders online the feature should generate a customer order report. The report shows *date of order, customer name, customer address* and *item codes* ordered. Explain how this online orders collection feature can be developed. List down software tools/packages you would use in developing the feature. Draw a flow chart for generating an instance of the customer order report. Write SQL statement that will generate the customer order report. (10 Marks)

5) What is the difference between a distributed database system and a centralized client server database system? Explain situations where each would be applicable. Name one company/organization in Bhutan which should adopt distributed database approach stating clear reasons. (10 Marks)

** END **