Bahir Dar University

Bahir Dar Institute of Technology

Faculty of Computing

Entrance Examination for MSc. in IT Program (Summer Entry)

Exam Date: July 06, 2015 G.C. **Maximum Marks:** 100

Time: _____ **Duration**: 3 hours

Candidate Name: _____**Signature:**_____

General Instructions:

1. **Please ensure that, there are 6pages (including this page) in the question booklet.**
2. **The exam has 5 parts. Check this too**
   - **Part I. Programming (25%)**
   - **Part II. Software Engineering (15%)**
   - **Part III. Database System (25%)**
   - **Part IV. Internet Programming (15%)**
   - **Part V. Networking (20%)**
3. **Please write your full name in all answer pages.**
4. **All answers should be legible. Illegible answers shall not be given marks.**
5. **Please check that you have answered all five sections of the exam on five separate answer sheets:**
6. **Return both question booklet and answer papers at the end of exam.**

For Office Use Only:

Part	Part I (25%)	Part 2 (15%)	Part III (25%)	Part IV (15%)	Part V (20%)	Total (100%)
Mark						

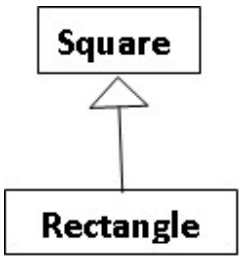
Part I: Programming (25 marks)

1. Write down outputs of the following code fragment in the space provided.**(2 marks)**

Code Fragment	Output

`int n = 8;`
`while (n >= 4){`
`for (int c = 2; c < n; c++){`
`if (n%2 == 0)`
`cout<<"X";`
`else`
`cout<<"O";`
`}`
`cout<<endl;`
`n = n - 1;`
`}`	

2. A perfect number is a number whose positive divisors, aside from itself, add up to itself. Write a (C++ or Java) function named *perfect* which takes positive integer and returns true if the number is perfect and false otherwise. **(4 marks)**
3. Identify appropriate attributes and methods for**Square** and **Rectangle** classes and code the inheritance hierarchy shown in the left in Java. The code has to be written in such a way that the object oriented concepts (*Encapsulation*, *Data Abstraction*, *Procedural abstraction*, *Polymorphism*) are manifested.Write main function to test your implementation. Referring your code (a line or a group of lines) describe succinctly the object oriented programming concepts mentioned. **(8 marks)**



4. Given 200 nodes, what are the maximum and the minimum heights a binary tree that could be formed from the nodes can have? How many leaves does each tree have? Explain your answer. **(5 marks)**
5. Write down bubble-sort algorithm and illustrate the execution of the array,

   A = <3, 5, 0, 2, 4, 1>

   For each fundamental iteration of the algorithm, write the content of the array.**(6 marks)**

Part II: Software engineering (15 marks)

1. Software development projects are full of risks which may cause the project to lag behind a schedule or fail entirely. List at least four example of the risks that may cripple/damage software projects. **(2 marks)**
2. What is the basic difference between software architecture and software design? What similarities do the two have? **(4 marks)**
3. Explain the difference between the two important concepts in software quality: validation and verification **(4 marks)**
4. The next two sub questions are based on the case study given below. **(5 marks)**

   A supermarket needs to develop software to encourage regular customers. For this, the customer needs to supply his name, address, telephone number and driving license number. A customer is assigned a unique customer number by the computer. When a customer makes a purchase, the value of the purchase is credited against his customer number. At the end of each year, surprise gifts to 10 customers who have made the highest purchase is given.

   A. Extract and write three functional requirements from the case study. *The requirements should have all the desired characteristics of individual requirements*. **(3 marks)**

   B. Write out two most important nonfunctional requirements you think for the system described in the case study. *The requirements should have all the desired characteristics of individual requirements.***(2 marks)**

Part III: Database System (25%)

1. Explain the three levels of database design. (**3marks**)
2. What is the difference between stored and derived attributes? Mention examples. (3 points)
3. Define referential integrity and show its importance. (**4marks**)
4. Based on the following functional dependencies, determine the Normal Form of the relation SCHEDULE (explain why) and, if necessary, bring it into a set of 3NF relations. **(5marks**)

   Dependencies:

   Section#, CourseID, Semester ID →RoomNo

   Section#, CourseID, Semester ID →Inst_ID

   Section#, CourseID, Semester ID →Week_day

   Section#, CourseID, Semester ID →Start_time

   Section#, CourseID, Semester ID →End_time

   Course_ID→ Course Name

   RoomNo→ Occupancy

   Instr_ID→Instr_name

   SCHEDULE

   (CourseID, Course Name, Section#, Semester ID, RoomNo, Occupancy, Inst_ID, Instr_Name, Week_day, Start_time, End_time)
5. Draw ERD for the following scenario: (**5 marks**)

As a part of its project management database, a company wants to store information about resources (employees), projects and bookings. For each employee, the following information is stored: Employee ID, First and Last name, Rank, and billing rate. Employees are organized into solution sets (SS), each solution set has a head of the solution set, who is the resource owner for all employees in that SS. For each solution set we record the SS ID and the SS name. For scheduling purposes, we want to store information about the head of each solution set, and about assignment of employees to solution sets. An employee can belong to only one solution set. The scheduling system also stores information about project. For each project, the following information is stored: Project ID, Status, Location and Client name. As part of the scheduling system, we store information about each calendar day in a year. When a booking is requested for an employee, the employee is scheduled to work on a particular project, on a particular day for the specified amount of time. For each booking we also record current status.

Part IV: Internet Programming (Max. 15 Marks, 15%)

1. Define a socket? How read and write is performed using sockets? (**3 marks**)
2. What are the major components of a web browser? Draw a neat diagram toexplain them. (**4 marks)**
3. What is the advantage of caching in a web browser? (**4 marks)**
4. IP specified that datagram can arrive in a different order than they weresent . If a fragment from one datagram arrives at a destination before al l the segments from a previous datagram arrive, how does the destination knowto which datagram the fragments belong? (**4 marks)**

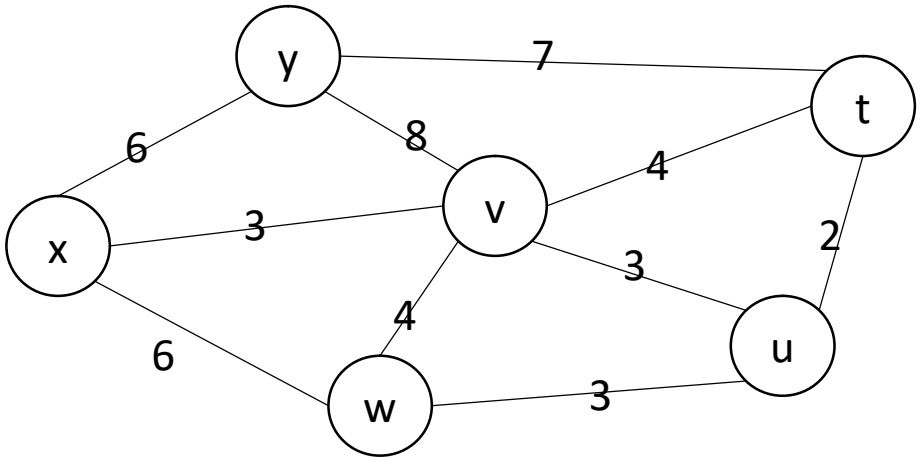
Part IV: Networking (20%)

1. Bahir Dar University is establishing an **ICT village**. The village has three buildings: a software development building, a training building and an administration building. The software development building has four stories (floors) and each floor has about three huge development rooms that contain 25 desktop computers each. The developers use desktop, laptop, IPD, tablets and smart phones to take notes. The ground floor has a server room and a presentation room. The server room contains different servers: Email Server, Web Server, Databases server and etc. The presentation room contains a camera, LCD projector and one desktop computer projector to conduct discussions, seminars and presentations. The training building is a three story (floor) building that contains two training halls, two syndicate room and two offices in each story. The syndicate rooms are used to conduct a group discussion in small groups and the offices are used for trainers. Each training room has 25 laptops, LCD projector, camera (mounted) and the necessary equipment's for the training. The training manager controls all the training processes using a desktop or laptop or other mobile devices (tablet, smart phone etc). The training building is found on the right of the software development building with a distance of 200 meters. The administration building is found at the back of the Software development building. It has about 10 offices, a lounge and one meeting hall. Each office is equipped with a desktop computer. The administration building has four shared printers that can be accessed by authorized users only.

   Considering the above scenario, please answer the following questions:

   a) What type of network should be deployed (installed) in the software development building and what equipment's should be installed? **(3 marks)**
   b) *What type of network connection should be used to link the buildings together and where and how the Internet connection be made? How do guests or visitors access to the Internet in the Village? (**4 marks)***

2. List the TCP/IP suit protocols and discusses in short the functionalities of each layer, the protocols found in each layer and the services each layer provides (**7 marks).**
3. Consider the following network. With the indicated link costs, use Dijkstra's shortest-path algorithm to compute the shortest path from x to all network nodes. Display the results in a table (**4 marks).**



4. What is the similarity and difference between circuit switching and packet switching network (**2marks)?**