Second Year B.Sc. (First Semester) Examination 2014
Computer Science & Engineering
University of Dhaka
STAT 2122: Introduction to Probability

Time: 2 ½ hours **Full Marks: 60**

Answer any four (4) questions.

1. (a) How many permutations of the letters in the word "SCIENCE" are possible? 3

(b) A coin is tossed until it falls heads for the first time. Write down the sample space of this experiment. 3

(c) Two coins and a die are tossed. Write down the elements of the event that the second coin falls heads. 3

(d) Suppose that A and B are mutually exclusive events for which $P(A) = 0.3$ and $P(B) = 0.5$. What is the probability that (i) either A or B occurs (ii) A occurs but B does not and (iii) both A and B occur? 3

(e) A circle of radius 1 is inscribed inside a 2×2 square. A particle is dropped such that it is equally likely to fall at any point of the square. What is the probability that it will fall inside the circle? 3

2. (a) Suppose that 40% of emails are spam. You want to design an "email filtering system" to deal with spam. You have prepared a list of "spam words" (words and phrases that are usually found in spam). If an email is spam, it contains spam words with probability 0.90. On the other hand, a regular email contains spam words with probability 0.05. 3
(i) What is the probability that a randomly chosen email contains spam words?
(ii) If the email contains spam words, what is the probability that it is spam?

(b) If $A \subset B$, simplify (i) $P(A \mid B)$ (ii) $P(A \mid B^C)$ and (iii) $P(B \mid A)$. 3

(c) Events A and B are equally likely and independent. If $P(A \cup B) = 0.75$, find $P(A)$. 3

(d) A system works if at least one of the four components A, B, C and D works. The components work independently with probabilities 0.9, 0.8, 0.7 and 0.6, respectively. What is the probability that the system works? 3

(e) For a particular unfair die, the probability of a "6" is 0.1. The die is thrown twice. What is the probability that "6" occurs exactly once. 3

3. (a) The joint probability function of X and Y is given below 6

$$P(X = x, Y = y) = \begin{cases} 0.1 & (x,y) = (1,1) \\ 0.2 & (x,y) = (1,2) \\ 0.3 & (x,y) = (2,1) \\ 0.4 & (x,y) = (2,2) \end{cases}$$

i) Find $P(X = 1 | Y = 2)$
ii) Are X and Y independent? Justify
iii) Find mean of Y

(b) The joint density function X and Y is given below 6

$$f(x,y) = \begin{cases} \frac{2}{3}(2x + y) & 0 < x < 1, 0 < y < 1 \\ 0 & otherwise \end{cases}$$

i) Find the marginal density of X
ii) Find $P(y < 0.5 | x = 0.2)$
iii) Find $V(Y | X = 0.2)$

(c) The density of X is given below. Find moment generating function of X. 3

$$f(x) = \frac{1}{\sqrt{2\pi}} \exp(-x^2/2) \quad -\infty < x < \infty$$

4. (a) There are ten multiple choice questions on an examination. If there are five choices per question, What is the probability that a student will answer at most two questions correctly just by picking one answer at random from the possibilities for each question? State any assumptions. 5

(b) Is it possible to have a binomial distribution with mean 5 and standard deviation of 2.4? Explain. 2

(c) The number of meteors found by a radar system in any 30-second interval under specified conditions average 1.81. Assume the meteors appear randomly and independently. 4

i) What is the probability that no meteors are found in a one-minute interval

ii) What is the probability of observing at least five but not more than eight meteors in two minutes of observation?

(d) In the National Basketball Association championship series, the team who wins four games out of seven will be the winner. Suppose that team A has probability 0.55 of winning over team B and both teams A and B face each other in the championship games. 4

i) What is the probability that team A will win the series in six games

ii) What is the probability that team A will win the series

5. (a) Mean and variance of a binomial random variable are 4 and 2, respectively. Find $P(X = 0)$. 3

(b) The average number of spots in a manufactured item is 3. Use an appropriate distribution to calculate the probability that there will be exactly 2 spots in the next item. 3

$\lambda = 3$

(c) Automobile battery of a particular brand malfunctions with probability 0.001. Use two appropriate distributions to calculate the probability that at least one out of 1000 batteries will malfunction. 3

$n = 1000 \quad p = 0.001$

(d) A box contains 2000 good phones and 1000 defective ones. You randomly selected 5 phones from the box without replacement. Use two appropriate distributions to calculate the probability that at least 2 out of 5 randomly selected phones will be good. 3

(e) In an MCQ test, there were 10 questions each with 4 choices. Smith did not study for the test at all and selected all the answers randomly. The next day he met the teacher in the corridor and learnt that the minimum mark was 2 out of 10 (that is, the minimum number of correct answers was 2), but the teacher could not tell him how much he obtained. What is the probability that Smith gets at least 4 out of 10? 3

6. (a) Lifetime of motherboards of a particular brand follows exponential distribution with average lifetime 4 years. What is the probability that the motherboard that you just bought will survive between 3 and 5 years? 3

$E(x) = \frac{1}{\lambda} \quad \lambda e^{-\lambda x}$

(b) Let $X \sim \text{uniform}(1, 7)$. Find $P(X > 5 \mid X > 4)$. 3

(c) The repair time of an electronic component follows normal distribution with mean 10 hours and standard deviation 2 hours. What is the probability that the next repair will take more than 12 hours? 3

$\mu = 10 \quad \sigma^2 = 2$

(d) Let $X \sim \text{Poisson}(\lambda)$. If $P(X = 1) = 4P(X = 0)$, find the value of λ. 3

(e) A fair die is thrown until '1' has occurred 4 times. What is the probability that exactly 7 throws will be required? 3

1 1 1 1 $\quad P(1\,1\,1\,1\,1\,1\,1)$

$P(x = 7)$

B. Sc. Second Year First Semester Examination 2014
Department of Computer Science and Engineering
University of Dhaka
Course: Ordinary Differential Equation (MTH-2121)

Full Marks: 60 Duration: 2 Hours 30 Minutes

Answer any **four** from the following questions.

1. a) Define degree and order of an ordinary differential equation with examples. Find the degree and order of the following differential equations. Also determine whether these equations are linear or non-linear in y (mentioning the reasons). 6

$$\text{(i)} \quad \frac{d^2y}{dx^2} + x^2 \sin y = 0$$

$$\text{(ii)} \quad \left(\frac{d^2y}{dx^2}\right)^{\frac{1}{3}} = c + \left(\frac{dy}{dx}\right)^2$$

b) What do you mean by exact differential equation? State the necessary and sufficient condition for exactness of a differential equation. Determine the most general function $M(x, y)$ such that the following equation is exact: 4

$$M(x, y)dx + (2ye^x + y^2e^{3x})dy = 0$$

c) What is the role of integrating factor in a differential equation? Find the integrating factor of the following differential equation. Hence solve it. 5

$$\frac{dy}{dx} + \left(\frac{2x+1}{x}\right) y = e^{-2x}$$

2. a) Write the standard form of Bernoulli's equation. Solve the following Bernoulli's equation: 5

$$\frac{dy}{dx} - \frac{x}{y^3} + \frac{y}{2x} = 0$$

b) Solve the initial value problem: 5

$$(x^2 + 1)\frac{dy}{dx} + 4xy = x \quad , \quad y(2) = 1.$$

c) Solve the following differential equation using any suitable method: 5

$$\left(y + \sqrt{x^2 + y^2}\right) dx - xdy = 0.$$

3. a) Solve the ordinary differential equation $y'' - 3y' + 2y = 2x^2 + e^x + 2xe^x + 4e^{3x}$ by the method of Undetermined Coefficient. 8

b) Solve the non-homogeneous ordinary differential equation $y'' + y = \tan x$ by the method of Variation of Parameter. 7

Turn over for the next questions.

1. a) Define Wronskian. Consider the following differential equation: 9

$$\frac{d^2y}{dx^2} - 5\frac{dy}{dx} + 4y = 0$$

(i) Show that e^x, e^{4x} and $2e^x - 3e^{4x}$ are solutions of the equation on the interval $-\infty < x < \infty$.

(ii) Use Wronskian to show that the solutions e^x and e^{4x} are linearly independent on $-\infty < x < \infty$.

(iii) Are the solutions e^{4x} and $2e^x - 3e^{4x}$ are still another pair of linearly independent solutions on $-\infty < x < \infty$? Justify your answer.

b) Solve the following differential equations: 6

(i) $\dfrac{d^4y}{dx^4} + y = 0$

(ii) $y'' - 6y' + 25y = 0, \qquad y(0) = -3, \qquad y'(0) = -1$

5. a) Given that $y = x$ is a solution of $x^2\dfrac{d^2}{dx^2} - 4x\dfrac{dy}{dx} + 4y = 0$. Find a linearly independent solution by reducing the order. Write the general solution. 7

b) Find the general solution of the Cauchy-Euler equation: 8

$$x^2y'' + xy' + y = 4\sin(lnx).$$

6. a) Define orthogonal trajectory. Find the orthogonal trajectory of the family of $y = cx^2$. 7

b) A body weighing 8 lbs. falls from rest toward the earth from a great height. As it falls, air resistance acts upon it and assume that the resistance is $2v$, where v is the velocity. Find the velocity and distance fallen at time t seconds. 8

B. Sc. Second Year First Semester Examination 2014
Department of Computer Science and Engineering
University of Dhaka
Course: Computer Architecture (CSE-2103)

Full Marks: 60

Duration: 2 Hours 30 Minutes

Answer any four from the following questions.

1. a) What is the difference between combinational and sequential circuit? 3

   b) Explain the following addressing modes: 4
      (i) Auto indexing
      (ii) Register indirect with offset

   c) Consider the following C language code: 4

```
while (save[i]==k)
i += 1;
```

   Assume that i and k correspond to register r3 and r5 and the base of the array **save** is in r6. What is the equivalent ARM instructions corresponding to this C segment?

   d) Draw the state table for a 2-bit Stream Serial Adder. 4

2. a) Explain how to determine if a number is negative in the following representations: 3
      (i) Signed Magnitude
      (ii) 2's Complement

   b) Briefly describe a 3×5 unsigned combinational array multiplier, where multiplier $X = x_2x_1x_0$ and multiplicand $Y = y_4y_3y_2y_1y_0$. 6

   c) Express -1.5 in IEEE 32-bit floating-point format. 2

   d) Show how the floating-point additions are performed for 3.334×10^1 and 8.877×10^{-2}. Show the result in normalized form. 4

3. a) Describe the working principle of the accumulator-based CPU using its block diagram. Mention the merits and demerits of the accumulator-based CPUs. 6

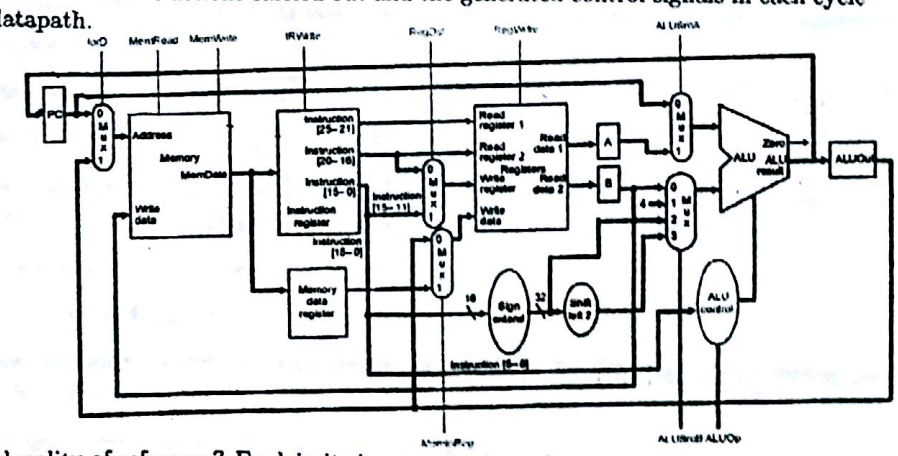
   b) Write a program in assembly language that calculates $Z := X + Y - R$; where, X, Y, R and Z refer to data words in M. 3

   c) Explain the relation between performance and execution time of a computer. If computer A runs a program in 10 seconds and computer B runs the same program in 15 seconds, calculate the relative performance of the computers. 6

4. a) Design a register file with a read port A and a write port B and eight 32-bit data storage. 4

   b) Describe the working principle of a pipelined carry save multiplier. 4

   c) Consider the instruction ***add $4, $5, $6*** for datapath of a multi-cycle processor shown below. Write down the actions carried out and the generated control signals in each cycle of the datapath. 7



5. a) What is locality of reference? Explain its importance in cache memory. 3

   b) Name the different cache replacement algorithms. Briefly explain any of them. 4

   c) Here is a series of address references given as word addresses: 2, 3, 11, 16, 21, 13, 64, 48, 19, 11, 3, 22, 4, 27, 6 and 11. Assuming a direct-mapped cache with 8 one-word blocks that initially empty, label each reference in the list as a hit or a miss and show the final contents of the cache. 5

   d) With the help of an example, define Normalization and Biasing. 3

6. a) Describe the communication of a CPU with main memory, cache memory and IO devices. 5

   b) Give the conditions for pipelining to take place. 3

   c) Explain different types of hazards in pipeline. How these hazards are handled in pipelined operations? 7

2nd year B. Sc. in Computer Science (1st Semester) Examination 2014
Department of Computer Science and Engineering
University of Dhaka
CSE 2101: Data Structures

Total Marks: 60 **Time: 2.5 Hours**

Answer any four (4) questions.

1. a) Each student in a class of 30 students takes 6 tests in which scores range between 0 and 100. Suppose the test scores are stored in a 30×6 array TEST. Write a module in pseudocode which finds the final grades for each student where the final grade is the average of the student's five highest test scores. 6

   b) Suppose Employee1 is a linked list. Write an algorithm which copies Employee1 into another linked list Employee2. Your required assumptions must be clearly stated. 4

   c) Write a procedure SORT which sorts a singly linked list without changing any values of an element of list. Your required assumptions must be clearly stated. 5

2. a) Hasan and Hafiza work for the same organization. The inventory of products they sell is a database of over 1000 entries. They are discussing a number of data structures that could be best applied to their individual needs. The choices are array, linked list, binary search tree, heap, AVL tree and hash table. 10

   I. Hasan is a sales person. His job is to convince the customer to buy a product. Once a customer has chosen a product, the only thing he needs is to find its availability and decrease its number in stock (if available). Which of the above data structure will lead to the most efficient way to handle his task? Explain his reason for the choice.

   II. Hafiza handles emergency situations. She has to find a product, which has its stock below a certain threshold, to reorder some from the manufacturer. Which of the above data structure will lead to the most efficient way to handle her task? Explain her reason for the choice.

   b) Consider A, B, C, D, E, F, G and H are 8 data items and suppose they are assigned weights as follows. 5

Data item:	A	B	C	D	E	F	G	H
Weight:	22	5	11	19	2	11	25	5

   Now construct the tree T with minimum weighted path length using above data and Huffman's algorithm. Draw the required figures to explain your answer.

3. a) Draw the binary search tree with the following numbers. 2

   45, 33, 23, 78, 43, 22, 13, 21

   b) Draw the binary search tree with the 22, 44, 66, 78, 102. What are the limitations of this binary search tree. 3

   c) Distinguish between AVL tree and red-black tree. 4

   d) Show the red-black tree that result after successively inserting the keys 41, 38, 31, 12, 19, 8 into an initially empty red-black tree. Please show the intermediate steps. 6

4. a) Define priority queue with example. Explain why heap is often preferable choice to implement the priority queue. 5

   b) Give an algorithm to find all nodes less than some value x in a binary max heap. 5

   c) Write a procedure to construct a priority queue. 5

5. a) Quick sort and merge sort both consist of three basic steps. Mention the steps and the activities involve in the both sorting algorithms. 5

b) Consider the numbers 13, 19, 9, 5, 12, 8, 7, 4, 21, 2, 6, 11. Sort the numbers using quick sort. Please show all the intermediate steps and mention your required assumptions.

c) Consider the numbers 5, 33, 86, 90, 105. How much partition will be generated after applying partition algorithm of quick sort. 3

6. a) What are the different approaches to represent a graph into memory? Describe one of them with example. 3

b) Consider that you have applied DFS on a given graph. Show that edge (u, v) is 8

i) a tree edge or forward edge if and only if $u.d < v.d < v.f < u.f$.

ii) a back edge if and only if $v.d \leq u.d < u.f \leq v.f$

c) Briefly describe working principle of breadth-first search. Mention some applications with justification. 4

University of Dhaka
Department of Computer Science and Engineering
2nd Year B.Sc.(Honors) 1st Semester Final Examination 2014
CSE 2102: Object oriented Programming

Full Marks: 60 **Duration: 2.5 hours**

[Answer any four (4) of the following Questions]

1. (a) Determine the data type and the value for each of the following expressions: 4
   (i) `5 > 6`
   (ii) `"2" + 1 + 0.009`
   (iii) `! (5.0 > 6 - 1.0 && ! (5.0! = 5))`
   (iv) `Math.min(6, ("int" + 98).charAt(3))`

   (b) Write a Java program that will create a class called ***Rectangle*** with the following properties: 7
   (i) Determine the data members according to your choice.
   (ii) A parameterized constructor to initialize all data members.
   (iii) A parameterized constructor to initialize all data members using that of an object of ***Rectangle***.
   (iv) A `toString()` method to return a string description of the instance of ***Rectangle***.
   (v) A method called ***compare_area (parameter_list)*** will compare the area of the calling object and the area of the rectangle represented by the parameters and returns the reference of the rectangle with larger area. Define ***parameter_list*** according to your choice.
   (vi) A method called ***compare_area (Rectangle R)*** will compare the area of the calling object and the area of ***R*** and return the reference of the rectangle with larger area.

   Write appropriate code to access the ***Rectangle*** class.

   (c) Describe the use of ***super*** keyword using suitable example. 4

2. (a) Describe the rules of passing parameters into a method in JAVA using proper example. 4

   (b) Write a Java Program that will contain an interface **T** and two classes **A** and **B**. Your program should have the following features: 7
   (a) The Interface **T** contains an abstract method void `show()` and a variable `a=125`.
   (b) The Class **A** implements **T**. This class contains two private data members **a** and **b**, an implementation of `show()` that will display the contents of **A** and **T** and an abstract method `operation()`.
   (c) The Class **B** is the subclass of **A**. This class contains a private data member **c**, a method `show(String msg)` that will display the contents of **A and B** and an implementation of `operation()` that will perform any operation (your choice) involving the contents of **T, A** and **B**.

   Write a **main ()** method to access all the classes and all the methods. Use dynamic method dispatch where applicable.

   (c) Discuss the operation of ***finally*** statement using suitable example. 4

3. (a) What is the difference between the `==` operator and an `equals` method? Why do we generally want to use an `equals` method when comparing object type variables as opposed to the `==` operator? State with example. 4

(b) Consider the following code segment: 8

```
interface Face1
{       public void bar();
}

class Class1{
      private int size = 0;
      private String name;

      Class1(String name){
            this.name = name; }

      public String getName(){
            return(name); }

      public void foo(){

System.out.println("Class1.foo()");
}
}
```

```
class    Class2    extends    Class1
implements Face1{
      int size = 0;
      int x;

      Class2(String name)
      { super(name); }

      public void foo(){

System.out.println("Class2.foo()");
}

      public void bar(){

System.out.println("Class2.bar()");
}
}
```

Determine output generated by each of the following cases with a brief explanation.

class 1. foo()

Case 1:

```
public class TestClass{
public static void main(String[] args){
      Class1 c = new Class2("me");
      c.foo(); }
}
```

Case 2:

```
public class TestClass{
public static void main(String[] args){
      Class1 c = new Class1("me");
      c.foo(); }
}
```

class 1. foo()

Case 3:

```
public class TestClass{
public static void main(String[] args){
  Class2 c = new Class2("me");
  System.out.println(c.getName()); }
}
```

Case 4:

```
public class TestClass{
public static void main(String[] args){
      Face1 c = new Class2("me");
      c.bar(); }
}
```

class 2. bar()

(c) How the concept polymorphism is implemented in Java? 3

4. (a) Write a Java program that will generate threads t_1, t_2 along with the ***main*** thread. Thread t_1 will write data into the even indices of an array while thread t_2 will write data into the odd positions of the array. Finally main thread will display the content of the array when write operations are done. 7

(b) Consider the following code segment: 8

```
public class OfficeBuilding {
   public int sqrFeet;
   private String name;
   protected double cost;

   public OfficeBuilding() {}
   protected boolean isBuilt()  {    ...  }
  public void moveIn()   {    ...  }
```

```
public double rentSpace()   {   ...   }
private int renovate(int days)   {   ...   }
...
}
```

Answer the following questions:

(i) Which members are visible to both OfficeBuilding and its subclasses?

(ii) Which members are visible to only the OfficeBuilding class?

(iii) Which members are visible to any class?

(iv) For which fields you should write getter and setter methods, so that classes outside OfficeBuilding and its inheritance hierarchy can access them?

5. (a) Is it possible to declare a class using only variables or using only methods? Justify your answer. What does a constructor do? What are the syntactic differences between a constructor and a method? 6

(b) Implement an abstract class **player** and two subclasses named **batsman** and **bowler.** Each player has a name, contact address, telephone number and status (either batsman or bowler). The **batsman** class maintains the total run obtained by a batsman and the number of one day matches he participated. Similarly, the **bowler** class maintains the total wickets taken by a player and the total number of matches. The parent class contains an abstract method to calculate the average of each player. Implement the above classes in Java. Provide constructors to initialize the private data. Override the **toString()** method in each class to display the class name. Write a program to create an object of type **batsman** and **bowler** and calculate the average run/ wickets obtained by a player. Your program should also call the **toString()** method to display the class name. 9

6. (a) What is the difference between *method overriding* and *method overloading*? Explain with example. 3

(b) "A superclass variable can refer a subclass object", do you agree? Justify your answer. 3

(c) State the advantage of an interface over an abstract class. Is it possible to partially implement an interface? Justify your answer with example. 3

(d) What happens if an exception occurs and an appropriate exception handler cannot be found? 3

(e) What is byte stream and character stream? Suppose in a program byte stream is required for IO operation. Name some classes that can be used for these purposes. 3

University of Dhaka
Department of Computer Science and Engineering
2nd Year B.Sc.(Honors) 1st Semester Final Examination 2014
CSE 2123: Introduction to Business

Full Marks: 60 **Duration: 2.5 hours**

[Answer any four (4) of the following Questions]

1 a) What are the criteria to determine the right type of business for an individual? Discuss. 7

b) What do you mean by merger? What are the different forms of merger? Discuss with example. 8

2 a) What is management? What are the basic functions of management? How do these functions are interrelated? 7

b) What are the different levels of management? Discuss. 5

c) Why are communication skills so necessary for success in the field of management? 3

3 a) What is marketing mix? What are the elements of marketing mix? Explain. 5

b) Briefly discuss the different steps of customer buying decision. 5

c) What are the different market targeting strategies? Discuss with example. 5

4 a) What do you mean by consumer product? What are the different types of consumer product? Discuss with example. 6

b) What is price? What are the objectives of setting price? Discuss. 4

c) Briefly explain the pioneer pricing strategies. What conditions are required to meet to apply these strategies? 5

5 a) What is product life cycle? Describe different ways through which marketers try to extend their product life cycle. 7

b) Describe the buyer's decision making process. 8

6 a) Distinguish between money and currency. Describe the essential characteristics of money. 5

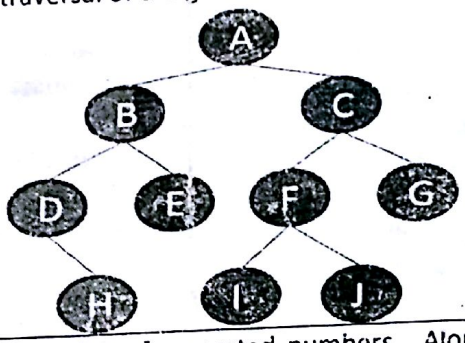
b) Aboron Pvt. Ltd. exports men's and women's casual wears to USA. Use the following information to prepare an Income Statement for the year ended on 31 December 2007 and a Balance Sheet as on 31 December 2007: (all figures are in US $). 10

Gross Sales 1,55,500
Sales Discounts 6,300
Accounts Payable (A/P) 15,000
Advertising expenses 8,000
Rent 7,500
Gas bill 1,500
Capital Stock 1,40,000
Insurance Expenses 1,000
Retained Earnings (Dec 31, 2006) 16,500
Short-term Bank Loan 45,000
Long-term Bank Loan 60,000
Salary 12,000
Notes Payable 23,000
Electricity bills 5,950
Machinery's 27,000
Income tax 40% on EBT
Accounts Receivable (A/R) 20,000
Cash 88,250
Furniture 4,500
Inventory 23,250
Sales Return 4,000
Interest expense 6,000
Telephone bills 2,400
Land 1,20,500
Building 43,000
Transportation 3,750
Cost of goods sold 52,100

Data Structure Lab Quiz

Total Marks: 20 Time: 30 Min

Set: 2

1. If you are given several data structures such as Link list, Two-way linked list, stack, queue and etc, and asked to implement file system used by MS Word or other word processing software where any number of undo and redo can be supported. Then name the data structure(s) with justification of your naming to efficiently implement such system.	[3]
2. For the given expressions, derive its prefix notation and evaluate: a. 11+2*5-9*(6+4*5)-6	[3]
3. You must have heard the rules of matrix multiplication. Now, consider the following chain of multiplication of matrices and determine the dimension of resulting matrices. a. ((P.Q).R).(M.N) b. (P.Q.(R.M).N) c. (P.N).(Q.R.M) Where, M = 6 x 4, N = 4 x 11, P = 5 x 4, Q = 4 x 9, R = 9 x 6.	[4]
4. Perform post order traversal of the given tree :  	[4]
5. Suppose you are given a list of un-sorted numbers. Along with that a stack and a queue are also provided. Your task is to state the idea of storing the numbers in the queue in sorted order.	[3]
6. Write a recursive program to calculate second minimum value of a given list of numbers.	[3]