Saima
17th batch

University of Dhaka
Department of Computer Science and Engineering
2nd Year B.Sc.(Honors) 1st Semester Final Examination 2012
CSE 2101: Data Structure

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

each element is related to one other
" " " " " many "

Answer any four (4) questions.

1. a) Write down the features of a i) linear data structure ii) tree data structure. 4

b) An n-square matrix array A is said to be symmetric if $A[j, k] = A[k, j]$ for all j and k. Suppose A and B are two n-square symmetric matrices. Describe an efficient way of storing A and B in memory. 5

c) Distinguish among O, Ω and Θ-notations. Order the following terms in ascending order. 6

O(n), O(100), O(nlogn), O(logn), O(n^2)

2. a) Sort the following values using Quick Sort. 7

100	50	91	45	80	60	110	45

Describe a case where quick sort will result in quadratic behavior.

b) Suppose 9 cards are punched as follows: 5

348, 143, 361, 423, 538, 128, 321, 543, 366

Sort the numbers using a card sorter which uses Radix sort.

c) Mention the advantages and disadvantages of linked lists over arrays. 3

3. a) Convert the following infix expression Q to its equivalent postfix expression P. Evaluate the resultant expression using postfix expression evaluation algorithm. 7

Q: 12/(7-3) + 2*(2^4+3) % 10

b) Consider the following queue of characters, where QUEUE is a circular array which is allocated six memory cells: 4

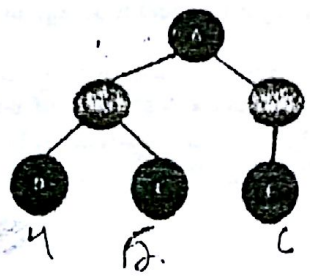
FRONT = 2, REAR=4, QUEUE: __, A, C, D, __, __

Describe the queue including FRONT and REAR, as the following operations take place:

i. F and K are added to the queue ii. Two letters are deleted iii. R is added to the queue iv. One letter is deleted

c) Write an algorithm to delete an element with a given location from a sorted linked list. 4

4. a) What are the differences between a complete binary tree and a 2-tree? The following is a binary tree T. How this tree can be represented in memory? 6



1 2 3 4 5 6
A B C D E F

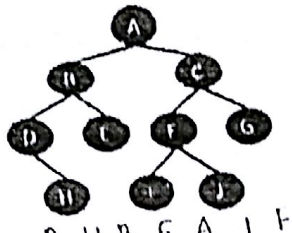
b) A binary search tree T has 13 nodes. The postorder and preorder traversals of T yields the following sequences of nodes: 4

Postorder: 15 20 20 40 30 55 65 60 73 70 75 70 50

Preorder: 50 30 20 15 20 40 70 60 55 65 75 70 73

Draw the tree T.

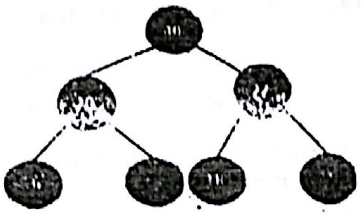
c) Using a stack, show the inorder traversing of the following tree T.



D H B E A I F J C G

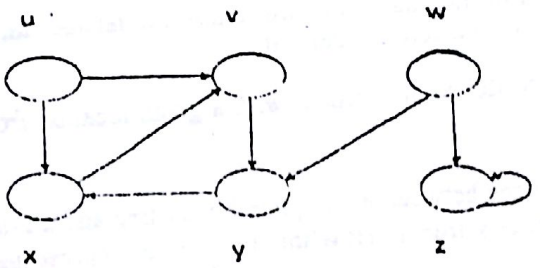
5 a) Write an algorithm to delete a node from a BST which has two children. 4

b) Consider the following maxheap H. Show the heap after deleting the root node. 4



c) Given, a set of alphabet A = {a, b, c, d, e, f, g, h, i} and a set of costs C = {4, 15, 25, 5, 8, 16, 10, 5, 3}. Find a set of prefix binary character code-words with minimum weighted path length using Huffman coding algorithm. 7

6 a) Write an algorithm to traverse a graph using DFS. Demonstrate this algorithm on the following graph and also show the resultant Depth First forest indicating each type of edges. 6



b) Analyze the complexity of BFS algorithm and topological sort. 3

c) What is hash data structure? How the location of an element is determined in the hash table? Consider a hash table of size 11 and the hash function is defined by the Division method. Add the numbers {10, 22, 31, 4, 15, 28, 17, 88, 59} into the hash table where collisions are resolved by linear probing. 6

University of Dhaka
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2nd Year B.Sc.(Honors) 1st Semester Final Examination 2012
CSE 2103: Computer Architecture

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

Answer any four (4) questions.

1. a) Describe the construction of the Turing Machine. 3
   b) Write down the basic instruction format of a Turing Machine. What is the meaning of each part of the instruction? 6
   c) On which parameters the performance (or, the limitation) of a computer depends on? Describe briefly. 6

2. a) Describe the 32-bit IEEE 754 floating point number representation for binary computer systems. 5
   b) Suppose, a = -2.5 and b = 0.625. Represent a and b in the 32-bit IEEE 754 format for both big-endian and little-endian systems (consider up to 5 bits in the mantissa part). 2.5×4 =10

3. a) What is "*Register File*"? Draw the basic block diagram of a register file with 3 access ports (two read and one write ports). 2+4
   b) Describe the design principle of a sign-magnitude fixed point multiplier. 6
   c) Draw the data path diagram of a 2's complement multiplier. 3

4. a) Briefly describe the advantages of virtual memory system. 4
   b) Suppose, in a two level memory system the access times for levels M1 and M2 are 1ms and 10ms, respectively. The block transfer time to transfer a block of memory from M2 to M1 is 1280ms. With a 95% hit ratio, what is the average access time for the memory system? 6
   c) What are the basic differences between the concepts of *segment* and *page* in virtual memory architecture? 5

5. a) What do you understand by pipelining? On what the speed up of a pipeline depends? 4
   b) Give the conditions for pipelining to take place. 3
   c) Explain different types of hazards in pipeline. How these hazards are handled in pipeline operation? 8

6. a) Mention the basic types of control architectures for computer systems. 3
   b) What is state-table and excitation table? With an example of GCD functional unit, draw the state-table and excitation-tables. 8
   c) Find the expressions of carry bits for a 4-bit carry lookahead adder. 4

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2nd Year B.Sc. (Honors) 1st Semester Final Examination 2012
CSE 2102: Object Oriented Programming

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

(Answer any four (4) of the following questions)

1. a) Differentiate between primitive types vs. reference types in java. 2

b) Consider the following two fragments of codes. 3

```
while(true){
String x= new String("HELLO");
}
```

A

```
while(true){
String x= "HELLO";
}
```

B

Which one is more preferable to use? Why?

c) What is constructor overloading? Give example. What happens when a return type, even void, is specified for a constructor? 4

d) You are probably wearing on your wrist one of the world's most common types of objects – a watch. Discuss how each of the following terms and concepts applies to the notion of a watch: object, attributes, behavior, class, inheritance, and encapsulation. 3

e) Try to find possible memory-leak for obsolete references in the following code and give solution to remove the obsolete references. 3

```
class Stack {
    private Object[] elements;
    private int size = 0;
    private static final int DEFAULT_INITIAL_CAPACITY = 16;
    public Stack() {
    elements = new Object[DEFAULT_INITIAL_CAPACITY];
    }
    public void push(Object e) {
    ensureCapacity();
    elements[size++] = e;
    }
    public Object pop() {
    if (size == 0)
    throw new EmptyStackException();
    return elements[--size];
    }

    /** Ensure space for at least one more element, roughly
    * doubling the capacity each time the array needs to grow.
    */
    private void ensureCapacity() {
    if (elements.length == size)
    elements = Arrays.copyOf(elements, 2 * size + 1);
    }
    }
```

2. a) Mention the scope of local variable, parameter, method, and instance variable. → class variable 2

b) Write meaningful interrelated two classes that use "this" and "super" keywords. 3

c) Describe any form of polymorphism in Java. – Method overloading 3

d) A Dancer has a name and may have a partner who is also a Dancer. If Dancer 'A' chooses Dancer 'B' to be a partner, the operation succeeds if neither A nor B already has a partner, and A is not B. Write the class Dancer so that we can operate it like the code below: 5

> Dancer rita = new Dancer("senorita rita");
> Dancer tony = new Dancer("mr tony");
> rita.getName()....."senorita rita"
> rita.hasAPartner().....false

```
> tony.hasAPartner()......false
> rita.choosePartner(tony).....true
> rita.hasAPartner().........true
> rita.getPartner().getName()........."mr tony"
> tony.hasAPartner().........true
> tony.getPartner().getName()........."senorita rita"
> tony.choosePartner(rita)..........false
> Dancer elana = new Dancer("ms elana");
> elana.choosePartner(elana)..........false
```

2

e) Suppose a subclass inherits a method implementation from a superclass, and implements a Java interface (that's the "interface" keyword) that contains a method with the same name and prototype.

a. Will Java compile the result? What if the method declaration in the interface has a different return type?

b. What if the method declaration in the interface has the same return type, but a signature with a different parameter type?

3. a) What are abstract methods? Illustrate the condition in which an abstract method would be more appropriate. 3

b) The following code has error. There are at least two possible ways to solve the error. Give the solutions. You can only add new lines, modify or rearrange the existing ones. But you cannot delete any line. 4

```
class Simple {
   private int a;
   private int b;
   public Simple(int i, int j) {a = i; b = j;}
   public Simple(int i) {a = i; b = i;}
   public void show()
   {
      System.out.println(a);
      System.out.println(b);
   }
   public static void main()
   {
      final int ARRAY_SIZE;
      int a[] = new int[ARRAY_SIZE];
      int b[] = {0, 1, 2, 3, 4, 5, 6, 7, 8, 9};

      for (int i = 0; i <= b.length; i++) {
         System.out.printin(b[i]);
      }
      show();
   }
}
```

c) Write a Java program that will perform the following operations: 3

i. Create an object of type *ArrayList* that will contain a list of floating-point numbers.

ii. Now insert the following data: 12.34, 34.5, 5.6, 7.89, 10.12, 3.45

iii. Show the number of elements in the object.

iv. Remove 5.6 and 10.12.

v. Display the content of the object

d) Compare and contrast abstract classes and interface. 3

Detect the error in the following code if any. Try to solve it as many as possible ways. 2.

```
package p1
class Fruit {
        static String name = "Sue";
}

Package p2
class Apple extends Fruit {
}
public class Application {
        public static void main(String[] args) {
                System.out.println(Apple.name);
        }
}
```

4. a) Mention the purpose of using throws clause and throw statement in exception handling. 2

b) Write a program that will take some positive integers from the keyboard and find their summation. If any negative number is input, then your program should handle it with a user-defined exception. 4

c) How can you create a thread with runnable interface? Give example. Is there any way for a thread to wait for other thread's completion? 3

d) Write a synchronize method and a synchronize statement in java. 3

e) 3

```
public class BadThreads {
   static String message;
   private static class CorrectorThread extends Thread
   {
      public void run() {
         try {
            sleep(1000);
         } catch (InterruptedException e) {}
         // Key statement 1:
         message = "The Exam is easy";
      }
   }
   public static void main(String args[]) throws InterruptedException
   {
      (new CorrectorThread()).start();
      message = "The Exam is not easy";
      Thread.sleep(2000);
      // Keystatement 2:
      System.out.println(message);
   }
}
```

The application should print out "The Exam is easy". Is it guaranteed to always do this? If not, why not? Would it help to change the parameters of the two invocations of Sleep? How would you guarantee that all changes to message will be visible in the main thread?

5. a) What is an event? How an event is generated in java? What is an event handler? 3

b) Describe applet's life cycle. How can you embed the applet with HTML. 3

c) The Java API defines the Comparable interface as 3

```
Interface Comparable
{
int compareTo(Object);
}
```

where x.compareTo(y) should return -1 if x is less than y, 0 if they are equal, and 1 otherwise. Define a class Person that implements Comparable and whose objects contain a age. Persons should be compared based on the age. For example,

```
Person m1 = new Person(10); //m1 has age 10
Person m2 = new Person(30); //m2 has age 30
System.out.println(m1.compareTo(m2)); //prints -1
```

Define just enough of the Person class for the above code to work.

d) 3

```
class x{
void show(){
System.out.println("X");
}
```

```
class y{
void show(){
System.out.println("Y")
}
```

```
class z{
public static void main() {
x a= xy.get("x");
a.show(); //prints X
y a = xy.get("y");
a.show(); //prints Y
```

See the above three class x,y,z. There class z needs a class xy that has a static method named get(String name). It returns the object of the class as specified in the name. See at first call with 'x' parameter it returns object of x and in next call with 'y' parameter it returns object of y. Now write the class xy to meet the purpose of class z. Hint: Use interface for class x and y and then use the concept of dynamic method dispatch.

e) Describe three Java GUI components: top level container, intermediate level container, atomic container/component. 3

Graph on use interface Frame Panel

6. a) Describe how un-buffered I/O and buffered I/O are implemented in Java Streams. 3

b) What is an adapter class? Why an adapter class is used in java? Give an example of adapter class. 4

c) 3

```
public class AnimalHouse<E> {
  private E animal;
  public void setAnimal(E x) {
    animal = x;
  } public E getAnimal() {
    return animal;
  }
}
```

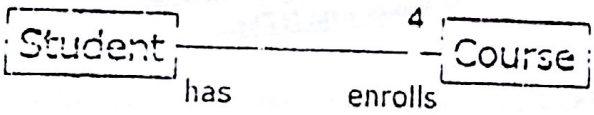
```
public class Animal{
}
public class Cat extends Animal {
}
  public class Dog extends Animal {
}
```

For the following code snippets, identify whether the above code:

a. fails to compile,
b. compiles with a warning,
c. generates an error at runtime, or
d. none of the above (compiles and runs without problem.)

i) AnimalHouse<Animal> house = new AnimalHouse<Cat>();
ii) AnimalHouse<Cat> house = new AnimalHouse<Animal>();
iii) AnimalHouse house = new AnimalHouse();
house.setAnimal(new Dog());

d) 2



For the above UML class diagram write necessary java classes.

e) Describe Use Case Diagram in UML. 3

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BUS 2123: Introduction to Business

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

(Answer any four (4) of the following questions)

1. a) Define the term economics and discuss three types of economic resources. 5
   b) Why is the sole proprietorship the most popular form of business ownership? Discuss. 4
   c) Discuss three basic economic systems. Which economic system is good for our country? Critically discuss from your point of view. 6

2. a) Why does a Computer Science and Engineering student study business? Why do some businessmen want to own a franchise of a major, well-known franchisor? 5
   b) Describe the characteristics of growth-oriented entrepreneurship and the risk of entrepreneurship? 6
   c) How might a firm encourage its employees to behave ethically?

3. a) Differentiate between balance of payment and balance of trade? 4
   b) Describe various approaches of International Business. 3
   c) Discuss the functions that successful managers must perform. Sometime managers are not interested for planning! Why? 5 7

4. a) How can managers create a positive environment in the organization? 4
   b) Discuss Maslow's view of needs and motivation. 6
   c) What activities does a HRM department conduct in a business firm? 5

5. a) Narrate some typical business activities that are performed by marketers. In today's competitive business environment, why is it essential for companies to practice the modern marketing concept? 8
   b) What are the functions of marketing intermediaries? 7
   c) Distinguish between a pull strategy and push strategy. Every day we watch a number of advertisements on television targeted to various types of customers. What type of promotion strategy it is – pull or push? Identify two television advertisements (local), one you like the most and another you do not like. Also give your arguments in favor of and against of those advertisements. 6
   b) What sources of funds would a new business owner count on to sustain the business? 4
   c) What are the four steps in accounting cycle? Discuss. 5

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MATH 2121: Ordinary Differential Equation

Full Marks: 60 **Duration: 2.5 Hours**

Answer any four (4) questions.

1. a) What do you mean by a differential equation and its solution? Obtain the differential equation of the family of curve $xy = c(e^2x - 1)$, c being a constant. Hence write its order and degree.

b) Use necessary and sufficient condition for exactness to solve the ODE
$(y^2 + 3)\,dx + (2xy - 4)\,dy = 0$

c) Solve the ODE by substitution method
$3e^x \tan y\,dx + (1 - e^x)\sec^2 y\,dy = 0$

2. a) Solve the ODE by Bernoulli's method
$dy/dx + xy = x^3y^3$

b) Define orthogonal trajectory. Find orthogonal trajectory of the family of parabolas
$y = cx^2$

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

3. a) Solve the initial value problem by the method of undetermined coefficient.
$y'' + 4y' + 4y = 3e^{-2x} + xe^{-2x}$ with $y(0) = 2$, $y'(0) = 5$

b) Solve the differential equation by the method variation of parameters
$4y'' + 36y = \csc 3x$

4. a) Define Cauchy-Euler equation with example. Find general solution of the differential equation $x^2y'' - 2xy' + 2y = x^3 \ln x$

b) If $y = (x + 1)$ is a solution of the differential equation $(x + 1)y'' - 3(x + 1)y' + 3y = 0$, find a linearly independent solution by reducing the order. Write the general solution.

5. a) Define ordinary point, singular and regular singular point of an ordinary differential equations with examples.

b) Use Frobenius method to solve the ODE
$2x^2y'' + xy' + (x^2 - 3)y = 0$

6. a) A thermometer is removed from a room where the air temperature is $70°F$ to the outside where the temperature in $10°F$. After ½ minute the thermometer reads $50°F$. What is the reading at 1 minute? How long will it take for the thermometer to reach $15°F$?

b) Find the general solution of the system
$x' = 3x + 2y$
$y' = -5x + y$