

Comilla University

Department of Computer Science and Engineering

2nd Year 2nd Semester Final Examination-2019

Session: 2017-18

Course Code: CSE- 2201

Course Title: Algorithm Analysis and Design

Full Marks: 60

Time: 03 Hours

N.B. 1) The figures in the right margin indicate full marks.

2) Answer any **five (05)** of the following questions:

01. a. What are the pre-requisites to design an algorithm? Briefly discuss about the general approach to calculate time and space complexity of an algorithm. 04

b. Interpret the following complexity notations with necessary examples: 02

I. $O(n^c)$

II. $O(\log n)$

c. Define time complexity. Determine the worst-case complexity in terms of n , in the form " $O(\dots)$ " of the following code: 04

```
int i=n, x=0;
while (i>0){
    i--;
    x+=A[i][n-i];
}
```

d. How to combine time complexities of consecutive loops? 02

02. a. Divide and conquer approach to the Merge-Sort technique yields the following recurrence relation. Draw a recursion tree for the recurrence and show that the complexity of the recurrence is $O(n \log n)$. 03

$$T(n) = \begin{cases} \theta(1) & \text{if } n = 1 \\ 2T\left(\frac{n}{2}\right) + c(n) & \text{if } n > 1 \end{cases}$$

b. Draw a recursion tree for the following recurrence and show that the height of the tree is $\log_{\frac{3}{2}} n$. 03

$$T(n) = T\left(\frac{n}{3}\right) + T\left(\frac{2n}{3}\right) + cn$$

c. State Master theorem for solving recurrences. Solve the following recurrences using Master theorem and find their corresponding asymptotic notation: 04

I. $T(n) = 9T\left(\frac{n}{3}\right) + n^2 \log n$

II. $T(n) = 2T\left(\frac{n}{2}\right) + \frac{n^3}{\log n}$

d. State Maximum Subarray problem. What will be sum of the values in a maximum subarray when all the elements of the array are negative? 02

03. a. What is memoization in DP? State rod cutting problem and apply memoization in the problem. [Illustrate with necessary algorithm] 04

b. What do you mean by overlapping subproblems? Consider the following code segment: 04

```
int LCS(i, j) {
    if (A[i]=='\0' || B[j]=='\0')
    {
        return 0;
    }
    else if (A[i]==B[j])
    {
        return 1+ LCS(i+1, j+1);
    }
    else
        return max (LCS(i+1, j), LCS(i, j+1));
}
```

1	2	3	4	5
1	2	5	3	4

001010

Simulate the above code for A= "qs" and B= "pqrs" and construct the recursion tree. Also, identify the overlapping subproblems.

c. Determine an LCS (Longest Common Subsequence) of string S1 and S2 using dynamic programming approach where, 04

S1= "10010101" and S2= "010110110"

04. a. Illustrate the operation of HEAPSORT on the following array: 03

A = {5, 1, 2, 2, 7, 1, 2, 8, 4}

25, 10

b. Find an optimal parenthesization of a matrix chain product whose sequence of dimension is {5, 10, 3, 12, 5, 50, 6} using DP approach. 05

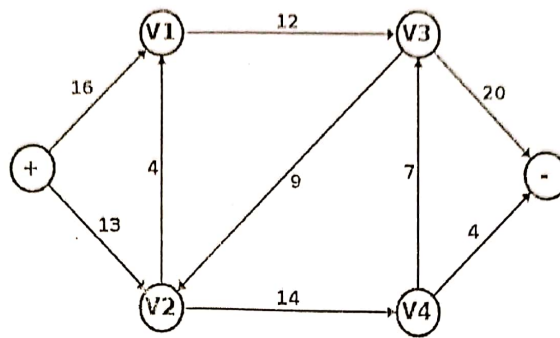
c. Consider a knapsack with a maximum capacity of 8 kg. Apply 0/1 knapsack on the following instances and produce the solution vector along with the maximum profit: 04

w[] = {2, 2, 4, 5} and p[] = {2, 4, 6, 9} where w[] and p[] represent the corresponding weights and profits of the items.

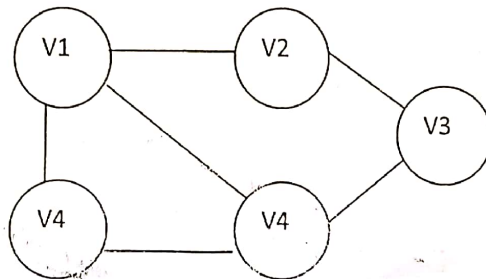
05. a. What is greedy choice property? Distinguish between greedy and dynamic programming approach. 03

b. "Greedy approach does not always guarantee to find an optimal solution."-Discuss briefly. 03

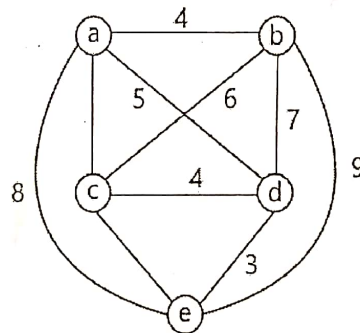
010101



08. a. State N-Queen problem. List the steps of the algorithm to solve N-Queen problem using backtracking approach. 03
- b. Define graph coloring. Write the graph coloring algorithm using backtrack technique. Apply graph coloring algorithm for the following graph. 04



- c. With the help of a state space tree, solve the travelling salesman problem of the following figure using branch-and-bound algorithm. 05



Comilla University
Department of Computer Science and Engineering
2nd Year 2nd Semester Final Examination-2019
Session: 2017 - 2018

Course Name (Course Code): Java Technologies (CSE 2208)

Time Allowed: 2 Hours

Full Marks : 30

[Answer any four (4) from the following questions. Figures to the right indicate full marks. Answer each part of the question consecutively. Writing anything in the question is strictly prohibited.]

1. a. Differentiate between early binding and late binding using appropriate examples. 2.5
- b. Consider three fruits "Mango", "Orange" and "Apple" shares some common attributes from "Fruit" class. Write necessary Java code to illustrate the scenario with class declaration and object creation process. 3.5
- c. What is the output of the given Java code snippet? 1.5

```
class TestApp {  
    int i[] = { 0 };  
    public static void main(String args[]) {  
        int i[] = { 1 };  
        alter(i);  
        System.out.println(i[0]);  
    }  
    public static void alter(int i[]) {  
        int j[] = { 2 };  
        i = j;  
    }  
}
```

Fruits
↓
Apple

2. a. "Java is called platform independent but machine dependent language" – Justify the statement in contrast with C++. 3.5
- b. Explain the use of "this", "super" and "final" keywords in Java with minimal code examples. 2.5
- c. What will be the output of given code snippet? 1.5

```
public class SimpleTest {  
    public static void main(String args[]) {  
        try {  
            args[0] = "0";  
            return;  
        } catch (Exception e) {  
            System.out.print("Exception");  
        } finally {  
            System.out.print("Final");  
        }  
    }  
}
```

3. a. Write down the output of the following code:

```
class A {  
    void show() {  
        System.out.println("This is Class A.");  
    }  
}  
  
class B extends A {  
    void show(){  
        System.out.println("This is Class B.");  
    }  
}  
  
class Override {  
    public static void main(String args[ ]) {  
        B obj = new B();  
        obj.show();  
    }  
}
```

2

- b. Write short note on: Polymorphism and Servlet.

3

- c. Can java support multiple inheritances? If yes, then explain with example.

2.5

4. a. Write down the output of the following code:

3

```
class Exp{  
    public static void main (String args[ ]) {  
        int p[] = {50, 120}, q=5, s;  
        try{  
            s=p[2]/p[1];  
        }  
        catch(ArithmeticException e) {  
            System.out.println("value of s is undetermined ");  
            System.out.println("\t(divition by zero)");  
        }  
        catch (ArrayStoreException e) {  
            System.out.println("Invalid data type ");  
        }  
        catch (ArrayIndexOutOfBoundsException e) {  
            System.out.println("Array index error ");  
        }  
        s=p[1]/p[0];  
        System.out.println("Now s is = " +s);  
    }  
}
```

- b. Differentiate between compile time and run time polymorphism.

2.5

- c. Write down the purpose of each of the following methods:

2

i) String toUpperCase()

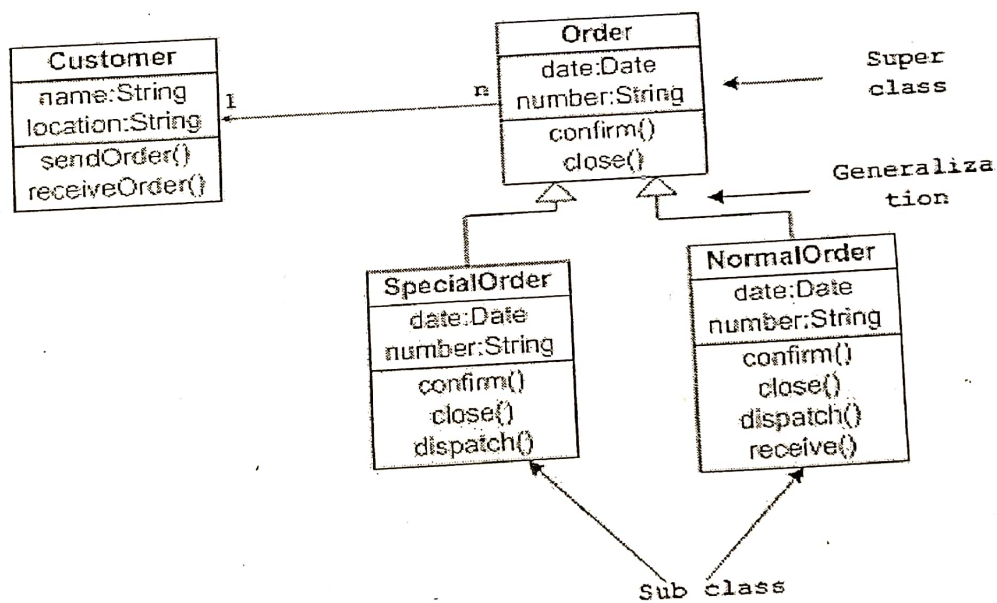
ii) indexOf(int ch)

5. a. What is I/O streams in Java? How Byte streams and Character streams differ from each other? Illustrate with an example. 3
- b. When to use Runnable interface or Thread class for implementing multithreaded programs in Java? 2.5
- c. What will be the output of given code snippet? 2

```
public class Test implements Runnable{
    public void run() {
        System.out.println("CSE");
    }
    public static void main(String args[]) throws
        InterruptedException{
        Thread th = new Thread(new Test());
        th.start();
        th.start();
        System.out.println(th.getState());
    }
}
```

6. a. Differentiate between Java Applet and Servlet with their functionalities, working principles, advantages and disadvantages. 3
- b. From the given sample class diagram, generate necessary Java code to write a program for Customer Ordering system. 3

Sample Class Diagram



- c. What are the benefits of Java Collections framework over custom API development? 1.5

COMILLA UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING
2nd Year 2nd Semester Final 2019
Course Code: CSE-2206 Course Title: Computer Architecture & Organization
Session: 2017-2018 Full Marks: 60 Time: 3 Hours
(Answer any 05 (five) questions from the following)

1. a. State Amdahl's law for multiprocessors with necessary equation and graph. [3]
b. What is the overall speedup if you make 90% of a program 10 times faster? [2]
c. Explain the principles of Cache Memory. [3]
d. Draw the typical Cache organization. [2]
e. Conclude the general relationship among access time, memory cost and capacity. [2]

2. a. There is a Sequence of nine memory references to an empty eight-block cache, including the action for each reference. Show the contents of the cache change on each miss and after handling all misses of address. [4]

Decimal Address of Reference	22	26	22	26	16	3	16	18	16
Hit or Miss	Miss	Miss	Hit	Hit	Miss	Miss	Hit	Miss	Hit

- b. How does an implementation of 2-way cache compare with that of a fully-associative cache? [4]
c. Describe four states of a simple cache controller. [4]
3. a. Explain Flynn classification. [3]
b. Draw the block diagram of Intel Core i7-990X. [3]
c. Why designers choice a multicore organization rather than increase parallelism within a single processor? Give your reasons. [3]
d. Explain the register organization of Intel 8086 processor. [3]
4. a. Consider the instruction "ADD R1, (R2)". Now write down the corresponding Micro instruction and control sequence for the given instruction. [3]
b. How Pipeline Works? [3]
c. What are the advantages and disadvantages of Hardware Control Unit? [2]
d. Write the functionality of Microprogrammed Control Unit. [2]
e. What are the primary benefits of parallel processing systems? [2]

5. a. Draw the block diagram of the CPU and describe how instructions are executed inside it. [4]
- b. Describe the construction of main memory which has 1MB space and each cell contains 16bit data. [4]
- c. Suppose address of A=1001, address of B=1010, address of C=1011, and content of A=01, content of B=10. Execute the instruction C=A+B and explain it according to the block diagram of CPU. [4]

6. a. Briefly define the main structural components of a processor. [3]
- b. Explain the structure and memory format of IAS computer. [3]
- c. List out the key characteristics of a computer family. [3]
- d. A benchmark program is run on a 40 MHz processor. The executed program consists of 100,000 instruction executions, with the following instruction mix and clock cycle count: [3]

Instruction Type	Instruction Count	Cycles per Instruction
Integer arithmetic	45000	1
Data transfer	32000	2
Floating point	15000	2
Control transfer	8000	2

Determine the effective CPI, MIPS rate and execution time for this program.

7. a. Describe different types of Hazards in pipelining. [4]
- b. Draw the diagram of Microarchitecture of AMD Opteron X4 pipeline. [4]
- c. Find the average time to read or write a 512-byte sector for a typical disk rotating at 15,000 RPM. The advertised average seek time is 4 ms, the transfer rate is 100MB/sec, and the controller overhead is 0.2 ms. Assume the disk is idle so that there is no waiting time. [4]
8. a. What are the major strategical differences among sequential access, direct access and random access? [3]
- b. Clarify the following terms: [3]
- EPROM
 - EEPROM
 - SRAM
- c. Explain the Booth's algorithm for Two's complement multiplication. [3]
- d. Show the differences among positive overflow, exponent overflow and significant overflow. [3]