L-2/T-1/CSE **Date : 07/12/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CSE 203** (Data Structures)

Full Marks: 210. Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Write a sorting algorithm that can always sort n elements in $O(n \log n)$ time. Analyze the best-case and worst-case time complexity of the algorithm. **(7+8=15)**

   (b) Prove that any comparison sort algorithm requires $\Omega(n \log n)$ comparisons in the worst case. **(8)**

   (c) Write the counting sort algorithm. Prove that the algorithm runs in linear time. Explain why counting sort is stable. **(3×4=12)**

2. (a) Write algorithms for the search, insertion and deletion operations of skip lists. Show that the expected search, insertion and deletion time is $O(\log n)$ in a skip list with n entries. Also show that the expected space used is $O(n)$. **(18)**

   (b) Draw the 11-item hash table that results from using the hash function $h(i) = (2i + 5) \bmod 11$, to hash the keys 12, 44, 13, 88, 23, 94, 11, 39, 20, 16, and 5, assuming collisions are handled by double hashing using a secondary hash function $h'(k) = 7 - (k \bmod 7)$. **(12)**

   (c) Compare linked lists and skip lists. **(5)**

3. (a) What is an AVL tree? Show that the height of an AVL tree T storing n items is $O(\log n)$. **(10)**

   (b) Explain with examples the single rotation and double rotation operations on AVL tree. **(10)**

   (c) Write the differences between a binary-search tree and a min-heap. **(4+6+5=15)**

   Write two procedures for finding the tree-successor and the tree-predecessor in a binary-search tree.

   For the set of {11, 4, 25, 10, 36, 17, 21} of keys, draw a binary search tree of height 3.

4. (a) Write the properties of a red-black tree. Show the red-black trees that result after successively inserting the keys 51, 46, 41, 22, 29, 18 into an initially empty red-black tree. **(15)**

   (b) Explain the divide-and-conquer technique. Write the quick sort algorithm, and analyze the time-complexity of the algorithm. **(15)**

   (c) Write the properties of a B-tree. **(5)**

Contd P/2

CSE 203/CSE

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) What is a data structure? When is a data structure called a linear data structure? Write 4 (four) properties of a linear data structure. **(1.5+1.5+4=7)**

(b) Let **a** : $array[l_1..u_1, l_2..u_2]$ be a 2D integer array. Assume b is the base address of the array a. Then write the Array Mapping Function to calculate **address(a [i, j])** in **(5+5=10)**

(i) Column-major order

(ii) Row-major order

(c) Given a doubly linked list and an integer n, write a function **deleteLastNElements()** that deletes last n nodes from the given linked list. **(8)**

(d) What is a proper binary tree? Construct **the proper binary tree** whose inorder and postorder traversals are given as: **(2+8=10)**

Inorder : BUETCSE12

Postorder : BEUCTES21

6. (a) How do you implement a Queue using a Stack? What are the running time of **enqueue** and **dequeue** operations of such implementation? **(8+2=10)**

(b) Which type of traversal will traverse the binary tree in figure for Question 6(b) as: **BUETCSE12**? Write an algorithm for such traversal of a binary tree using a Stack or Queue. **(2+10=12)**

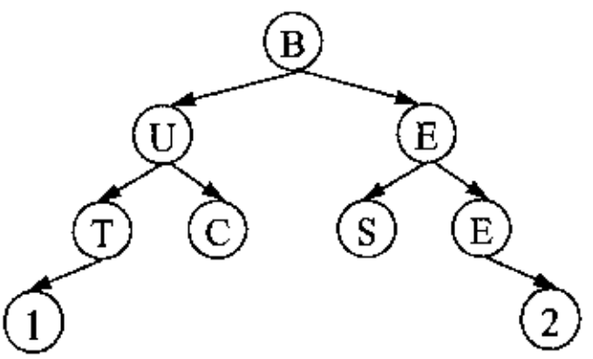

Figure for Question 6(b)

(c) Give a brief description of **(1.5+1.5+1.5+2.5=7)**

(i) Graph

(ii) Forest

(iii) Tree

(iv) Spanning subgraph

(d) Give a comparison of adjacency matrix and adjacency list representation of a graph. **(6)**

Contd P/3

CSE 203/CSE

7. (a) Give 2 (two) real life applications each for **(2+2+2=6)**

   (i) Stack

   (ii) Queue

   (iii) Priority Queue

   (b) Write pseudocodes for **enqueue** and **dequeue** operations for the array implementations of a circular queue. **(7)**

   (c) Assume an object which has two elements {key, element}. An array of such object is given in figure for Question 7(c). Then **(8+8+6=22)**

   (i) Convert the array into Max-heap.

   (ii) Insert (36, B) in the resultant Max-heat of 7(c)(i)

   (iii) Show each step of the Heap sort over the resultant Max-heap of 7(c)(ii).

14, U	11, E	13, T	12, C	26; S	19, E	20, W	24, P	18, O	17, L	7, A	8, S	9, H	10, I

Figure for Question 7(c)

8. (a) Give a comparison of array and linked list. **(6)**

   (b) Draw a binary tree whose preorder and inorder traversals both yield **BUETCSE12**. **(7)**

   (c) Consider a graph G as shown in figure for Question 8(c). Then **(6+6+4+6=22)**

   (i) Write the adjacency matrix and adjacency list of the Graph G.

   (ii) Draw the BFS forest of the graph G by assuming B as the starting vertex.

   (iii) Write the sequences of vertices if you explore the graph G starting from vertex B in DFS.

   (iv) Write the tree edges, back edges, forward edges and cross edges.

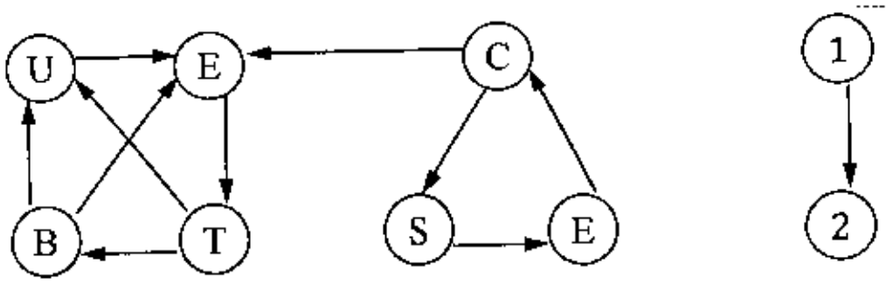

Figure for Question 8(c)

L-2/T-1/CSE **Date : 13/12/2014**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **MATH 241** (Complex Variables and Statistics)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Symbols used have their usual meaning.

1. (a) Prove that $|z_1+z_2|^2+|z_1-z_2|^2=2|z_1|^2+2|z_2|^2$ and hence deduce that $\left|a+\sqrt{a^2-b^2}\right|+\left|a-\sqrt{a^2-b^2}\right|=|a+b|+|a-b|$ where z_1, z_2, a and b are complex numbers. **(20)**

   (b) Find all of the roots of $\left(-2\sqrt{3}-2i\right)^{\frac{1}{4}}$ in rectangular coordinates and exhibit the distinct roots graphically. **(10)**

   (c) Describe mathematically and graphically the region represented by $|z+2-3i|+|z-2+3i|<10$. **(5)**

2. (a) Show that $f(z)=|z|^2$ is differentiable only at $z=0$. **(5)**

   (b)Show that $u(x,y)=\frac{1}{2}\log\left(x^2+y^2\right)$ is harmonic in some domain. Find a function $v(x,y)$ such that $f(z)=+iv$ is analytic in that domain and express $f(z)$as a function of z. **(15)**

   (c) Derive the Cauchy-Riemann equations and hence find the polar form of these equations. **(15)**

3. (a) Solve the equation $\cosh z=-2$ by equating the real and imaginary parts in the equation. **(8)**

   (b) Find the image of the hyperbola $x^2-y^2=1$ under the transformation $w=\frac{1}{z}$ and sketch the graph of the image. **(12)**

   (c) Evaluate the integral $\int_C \bar{z}dz$ around

   (i) the circle $|z-2|=3$. **(5)**

   (ii) the ellipse $|z-3|+|z+3|=10$. **(10)**

Contd P/2

MATH 241/CSE

4. (a) Evaluate $\int_C \frac{z}{(z+2)(z-4i)}dz$ by Cauchy's integral formula around the circle $C: |z-i|=4$ taken in positive sense. **(8)**

(b) Find a Laurent series expansion for $f(z)=\frac{1}{(z+1)(z-3i)}$ in power of $(z+1)$ and state the region of convergence of the series. **(8)**

(c) Find the residue of the function $f(z)=\frac{(\log z)^3}{z^2+1}$ at the point $z=i$. **(8)**

(d) Use Cauchy's residue theorem to evaluate $\int_C \frac{1+z^2}{(z-1)^2(z+2i)}dz$ where C is the circle $|z|=3$. **(11)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE.**

5. Evaluate the following integrals by using contour integration

(a) $\int_0^{2\pi} \frac{d\theta}{1+a\cos\theta}(-1<a<1)$ **(18)**

(b) $\int_0^{\infty} \frac{x^2}{x^6+1}dx$ **(17)**

6. (a) Lives of two models of refrigerators in a survey are as follows **(15)**

Life (No. of years)		0-2	2-4	4-6	6-8	8-10	10-12
No. of refrigerators	Model A	5	16	13	7	5	4
	Model B	2	7	12	19	9	1

Which model has greater uniformity.

(b) Calculate efficiency of skewness and kurtosis from the table given below. **(20)**

Class	10-20	20-30	30-40	40-50	50-60
Frequency	174	86	32	181	27

Also comment on the nature of the distribution.

Contd P/3

MATH 241/CSE

7. (a) Calculate the two regression equations and the coefficient of correlation from the data give below: **(20)**

Age of husband (in years)	22	25	28	31	35	32	37	39
Age of wife (in years)	19	18	22	29	31	23	30	33

Also estimate the most likely age of husband when wife's age is 24.

(b) (i) 3 cards are drawn from a deck of 52 cards one after another without replacement. Find the probability that they will come from different suits. **(7)**

(i) If 10% of the instruments produced by a company is defective, find the probability that out of 12 instruments, at least 4 instruments will be defective. **(8)**

8. (a) Talcum power is packed into tins by a machines A random samples of 11 tins is drawn and their contents are found to weigh (in lbs) as follows: **(20)**

0.44, 0.51, 0.49, 0.52, 0.45, 0.48, 0.46, 0.45, 0.47, 0.45 and 0.47

The whether the average packing can be taken to be 0.5 lbs at 5% level of significance. (Given: $t = \pm 2.23$)

(b) A survey of 320 families with 5 children each revealed the following distribution. **(15)**

No. of boys and girls	5 boys 0 girl	4 boys 1 girl	3 boys 2 girls	2 boys 3 girls	1 boys 4 girls	0 boys 5 girls
No. of families	18	56	110	88	40	8

Is the result consistent with the hypothesis that male and female births are equally probable? Use a 5% level of significance. (Given for $\nu = 5$, $\chi^2 = 11.07$)

L-2/T-1/CSE **Date : 05/01/2015**

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **EEE 263** (Electronic Devices and Circuits)

Full Marks: 280 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Symbols have their usual meanings.

1. (a) Figure 1(a) illustrates I-V characteristics of a diode. Figure 1(b) shows input voltage signal V_{in}. Draw the output voltage V_{out} across the resistor with reference to Figure 1(b). **(16+10)**

   (b) What would be the output voltage V_{out} across the resistor if the diode would have given a constant 0.7 volt voltage drop? **(10)**

   (c) What would be the output voltage if the diode and the resistor would have been parallel? **(10⅔)**

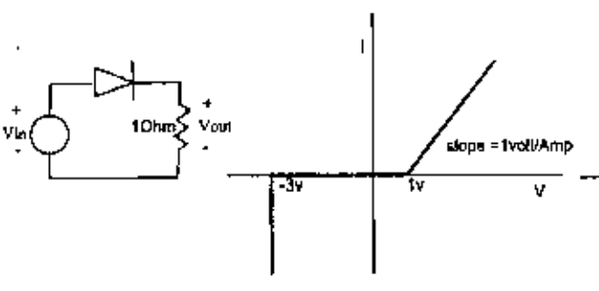

Figure 1(a)

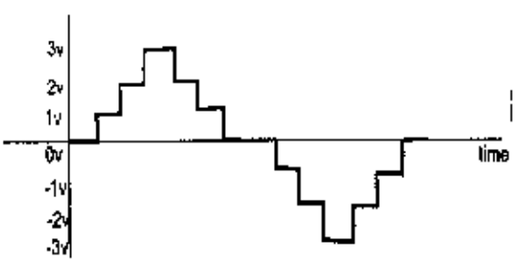

Figure 1(b)

2. (a) Draw output wave shape (v_0) and also v_i-v_0 graph for the circuit drawn in Figure for Q. No. 2-a. Assume constant 0.7 v forward voltage drop across the diode. **(20)**

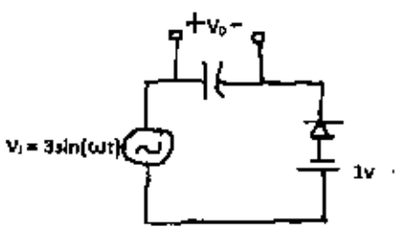

Figure for Q.no 2-a

Contd P/2

EEE 263/CSE

Contd... Q. No. 2

(b) Why digital processing of data is advantageous over analog processing? **(6)**

(c) Why do we need to miniaturize a transistor as much as possible? If you continue to miniaturize the transistor (switch), what are the problems that may surface? **(5)**

(d) Write a script in C language that will take a sinusoidal input and provide a full wave rectified output. **(5)**

(e) How does your computer program rectify the sinusoidal input mentioned above? Is there any diode inside the processor? If not, what makes that act of rectification possible? **(10⅔)**

3. (a) Why do we need to bias a BJT at a proper Q-point before using it as an amplifier? **(5)**

(b) Figure 3(a) is an inverter gate built by an npn BJT and Figure 3(b) is its output (V_0) voltage vs Base-Emitter voltage (V_{in}) characteristics. Copy Figure 3(b) to your answer script exactly to the scale and then draw collector current (I_c) of BJT versus input voltage (V_{in}) over the same graph. **(16)**

See how the co-ordinates of the bending points of V_0 - V_{in} graph is mentioned in Figure 3(b). Likewise, mention the co-ordinates of the bending points of I_C - V_{in} graph you have drawn.

(c) Modify both the V_0 - V_{in} and I_C - V_{in} graph if R_C is infinity. **(15)**

(d) Modify both the V_0 - V_{in} and I_C - V_{in} graph if supply voltage is decreased from 5v to 2.5v. (R_C = 480 Ω) **(10⅔)**

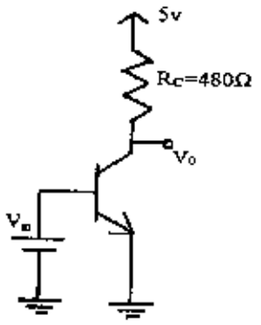

Figure 3(a)

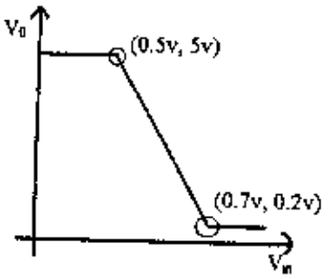

Figure 3(b)

4. (a) Draw the small signal circuit diagram of the CE circuit of Figure for Q. No. 4. Why is the circuit called "Small Signal" circuit? **(16)**

(b) Can you determine the value of input resistance R_{in}, output resistance R_{out} and voltage gain A_v of the given circuit? If v_{sig} = 2mV, find the value of V_{out}. **(20)**

EEE 263/CSE

Contd... Q. No. 4

(c) Compare MOSFET and BJT in terms of their operating principles. Mention each of their advantages and disadvantages. **(10⅔)**

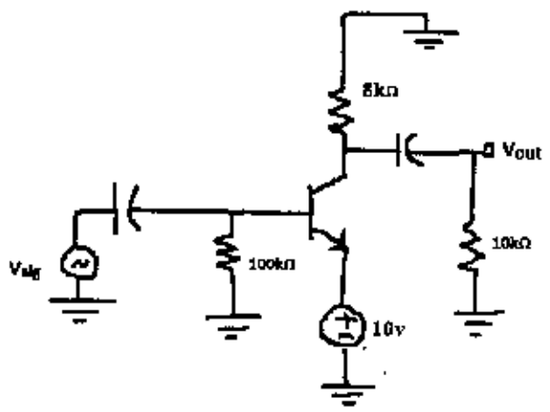

Figure for Q no. 4

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE.**

5. (a) Design the circuit shown in Fig. for Q. No. 5(a) to obtain a current I_D of 80 μA. Given, $V_t = 0.6$ V, $\mu_n C_{OX} = 200\ \mu A/V^2$, L = 0.8 μm, W = 4 μm and $V_A = 50$ V. **(16⅔)**

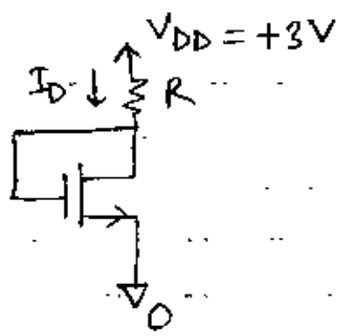

Fig. for Q. No. 5(a)

(b) For the CMOS inverter of Fig. for Q. No. 5(b), draw V_0 for the input V_{in} of Fig. for Q. No. 5(b). **(15)**

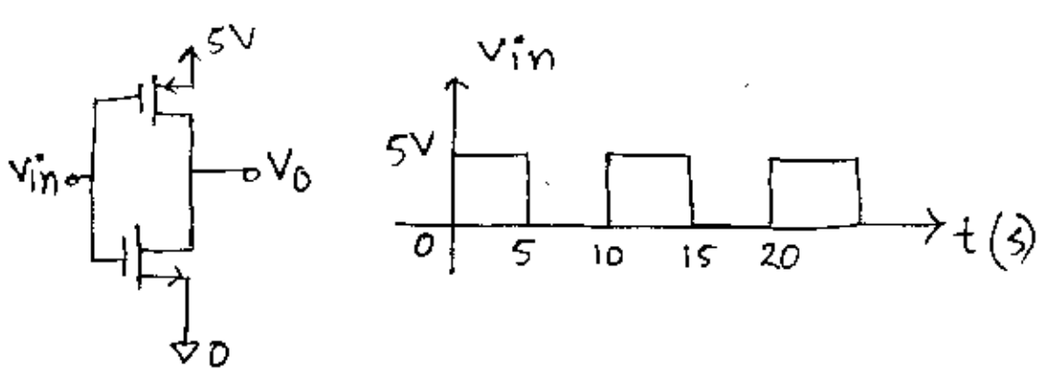

Fig. for Q. No. 5(b)

Contd P/4

EEE 263/CSE.

Contd... Q. No. 5

(c) Show that, a proper connection of a diode, a resistor and an op-amp can perform expotential function. [Mention the assumptions, if any] **(15)**

6. (a) Design a Wien Bridge Oscillator with a oscillation frequency of 1000 rad/sec. Available capacitors are 0.1 μF, 1 μF and 100 pF. **(16⅔)**

(b) A system blocks 20 Hz and 20 KHz but passes 10 KHz. **(7+8)**

(i) Draw the frequency response of the system.

(ii) Draw a block diagram of the system.

(c) Implement $z = 5V_1 - 3V_2$ using only one op-amp where V_1 and V_2 are input signals. **(15)**

7. (a) Derive the expression of input resistance, output resistance and overall voltage gain of a common gate (CG) amplifier. **(26⅔)**

(b) Design a 40dB Low Pass filter (LPF) with a cutoff frequency of 1 KHz. [You have only one op-amp] **(15)**

(c) What are the characteristics of an ideal op-amp? **(5)**

8. (a) For Fig. for Q. No. 8(a), find out the value of V_0. Given, for both NMOS, $V_t = 1$ V, $\lambda = 0$ and $\mu_n C_{OX}\left(\frac{W}{L}\right) = 1 mA/V^2$. **(16⅔)**

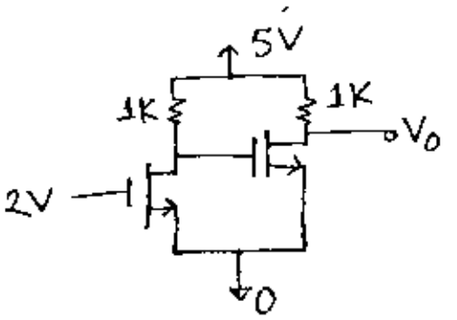

fig. for Q. No. 8(a)

(b) What are the AC imperfections of a practical op-amp. How can we find out the value of input offset voltage and input offset current. **(15)**

(c) Explain SCR and TRIAC operation with suitable examples. **(15)**

L-2/T-1/CSE Date : 10/01/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CSE 201** (Object Oriented Programming)

Full Marks: 210 Time : 3 Hours

USE SEPARATE SCRIPTS FOR EACH SECTION

The figures in the margin indicate full marks.

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

Use C++ as the reference language to answer all the questions in this section.

1. (a) Define automatic in-line function. What are the advantages of using in-line function over parameterized macros? **(5)**

(b) Consider the following class definition: **(10)**

```
class myclass {
    int *p;
public;
    myclass(int i){p=(int*)malloc(sizeof(int));*p=i;}
    ~myclass() {free(p);cout<<"Freeing..\n";}
int get() {return *p}
};
```

What is the problem when an object of the class type is passed to a regular function as a parameter? Write a copy constructor to resolve the problem.

(c) What is meant by friend function? When is a friend function used? Give an example of forward class declaration. **(10)**

(d) What is a reference? Name three different scenarios when a reference can be used Why does a reference use a dot(.) operator instead of an arrow (→) operator? **(10)**

2. (a) Explain why using a default argument is related to constructor overloading. What is wrong with the following function prototype? **(10)**

```
double area(double width=0, double length);
```

(b) Consider the following class definition: **(20)**

```
class coord{
    int x, y;
pulic:
    coord(int i=0, int j=0) {x=i; y=j;}
    vaoid getxy(int&i, int&j) {i=x; j=y;}
};
```

Contd P/2

CSE 201/CSE

Contd... Q. No. 2(b)

(i) Write a function to overload + operator where both the values of x and y are incremented by the amount passed through parameter.

(ii) Write a function that will allow the following operation:

```
ob2 = 100 + ob1;
```

(iii) Write an inserter and an extractor functions for the above class.

(iv) Rewrite the class definition incorporating above four functions.

(c) Explain why the protected access specifier is needed. **(5)**

3. (a) Consider that variable A contains an integer of value 10, variable B contains a double of value 123.234567 and variable S contains a string with value "hello". Write a C++ program that will generate the following output: **(10)**

OUTPUT:

```
     hello
%%%%%hello
hello%%%%%
123.234567
123.235%%%
```

(b) Write down a manipulator function named "setup" that will set a width of 10 characters, a precision of 4 and fill the leading blanks with the character '*'. **(10)**

(c) Consider the following class definition: **(15)**

```
class list {
public:
    list *head, *tail, *next;
    int num;

    list() {head=tail=next=NULL;}
    virtual void store(int i)=0;
    virtual int retrieve()=0;
};
```

Write a derived class with name "queue" that implements a queue by overriding the above two pure virtual functions.

Contd P/3

CSE 201/CSE

4 (a) Differentiate between early binding and late binding with appropriate examples. **(5)**

(b) Create a generic class, called input, that does the following when its constructor is called: **(20)**

- Prompts the user for input.
- Inputs the data entered by the user, and
- Reprompts if the data is not within a predefined range.

Objects of types input should be declared like this

Input ob("prompt message", min-value, max-vlaue);

Here the prompt message is the message that prompts for input. The minimum and maximum acceptable values are specified by min-value and max-value, respectively. (Note: the type of data entered by the user will be the same as the type of min-value and max-value.)

(c) A key/value pair stored in the vector "map". Write a genetic function that reads a key and then returns the associated value. **(10)**

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

All questions in this section are for Java

5. (a) Write down the difference between **(6)**

(i) String and StringBuffer classes

(ii) Method overriding and method overloading

(b) What are the properties of static variables and methods? Explain dynamic method dispatch with example. **(6+9=15)**

(c) A class Employee has two member variables: *name* (String) and *age* (int). Write the class with appropriate methods so that in another class an ArrayList of Employee objects can be sorted with respect to any of these member variables. **(14)**

6. (a) There is a file named "text.txt". Write a program that reads each line of the file at a time and prints the line number of the first occurrence of the word "Bangladesh". **(10)**

(b) Draw the life-cycle of Thread. Discuss "runnable" and "waiting" states of Thread in brief. **(10)**

(c) Consider two entities, the writer and the reader, who share a common buffer that is a single character. The writer's job is to generate English letters circularly from A to Z. The reader's job is to read and display them in the output. The writer can't write new letter if the reader does not read the already written letter. The reader can't read if the writer does not write any new letter. Use the concept of multi-thread communication and synchrenization with monitor to solve this problem using Java **(15)**

Contd P/4

CSE 201/CSE

7. (a) What is the difference between declaring a variable in a class with "protected" access modifier rather than no modifier? **(5)**

(b) Why deadlocks may occur while developing user interface? Write a program to show how this can be mitigated. **(4+7=11)**

(c) Write a class Student that contains a HashMap with an integer as key and List of String as values. Add a method in the class to put 3 studentIds as the keys and corresponding [firstname, lastname] as values. Write another method to print all of them. **(13)**

(d) What are the improvements in Swing over AWT? **(6)**

8. (a) How multiple inheritance is implemented in Java? Can abstract class be final – explain in brief. **(4+4=8)**

(b) What do you understand by serialization in the context of I/O in Java? What are the uses of serialization and how it can be implemented? **(6)**

(c) You have to develop a user interface where the user will be able to save data or cancel using either two buttons or from Menu. Each of the buttons and its corresponding menu item will have the same caption, mnemonic, tool-tip text and event-handling code. Implement this requirement using the most appropriate feature of Java. **(15)**

(d) Which one is preferred to use: semantic or low level events? Mention two examples of each type. **(6)**

L-2/T-1/CSE Date : 15/01/2015

BANGLADESH UNIVERSITY OF ENGINEERING AND TECHNOLOGY, DHAKA

L-2/T-1 B. Sc. Engineering Examinations 2013-2014

Sub : **CSE 205** (Digital Logic Design)

Full Marks : 210 Time : 3 Hours

The figures in the margin indicate full marks.

USE SEPARATE SCRIPTS FOR EACH SECTION

SECTION – A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) Simplify the following Boolean functions, using K-map: **(15)**

   (i) F(A,B,C,D)= AB'C + A'B'D' + ABD + ACD' + AB'C' + A'BC'D

   (ii) F(A,B,C,D)=(0, 2, 5, 7, 8, 15) which has the don't-care conditions: d(A, B, C, D) = (10, 14).

   (b) 'NOR gate and NAND gate are universal gate' – justify the claim. **(5)**

   (c) What is priority Encoder? Design a four-input priority encoder with inputs I0, I1, I2, and I3, where, the priority order is I2, I3, I1, I0. **(10)**

   (d) Define Odd Function. Even Function, Don't-care conditions. **(5)**

2. (a) Design a four bit binary adder using 1-bit full-adder circuit. How can it be modified to use as a four bit subtractor. **(15)**

   (b) How to check overflow in case of addition of two Binary numbers in both signed and unsigned representations. **(5)**

   (c) An 8×1 multiplexer has inputs A, B, C, D where, inputs A, B and C are connected to the selection inputs S2, S1 and S0, respectively. The data inputs I0 through I7 are as follows: I1 = I2 = 0; I3 = I7 = 1; I4 = I5 = D; and I0 = I6 = D'. Determine the Boolean function that the multiplexer implements. **(15)**

3. (a) Design a 3-bit synchronous binary up counter that counts 1-2-4-7-1-..., where any invalid state goes to the immediate next state in the sequence. Use J-K flip flop for your design. Show the state table, state diagram, function minimization (if necessary), and circuit diagram of your design. **(20)**

   (b) Design a serial subtractor that subtracts the content of B from the content of A where the content of A and B are stored in the individual shift registers. The result of the subtraction is stored in the shift register representing A. (Both A and B are 4-bit binary numbers). **(10)**

   (c) Write the differences between latch and flip-flop **(5)**

Contd P/2

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4. (a) What is the advantages of CLA over normal binary four bit adder? Assume that the exclusive-OR gate has a propagation delay of 10 ns and that the AND or OR gates have a propagation delay of 5 ns. What is the total propagation delay time in the four-bit CLA adder? **(10)**

   (b) Construct a 16 × 1 multiplexer with two 8 × 1 and one 2 × 1 multiplexers. **(5)**

   (c) What problem may occur when redundant states are present in the state diagram? **(5)**

   (d) Using an implication table, reduce the following state table to a minimum number of states and write the reduced state table. **(15)**

Present State	Next State		Output	
	x = 0	x = 1	x = 0	x = 1
A	F	B	0	0
B	D	C	0	0
C	F	E	0	0
D	G	A	1	0
E	D	C	0	0
F	F	B	1	1
G	G	H	0	1
H	G	A	1	0

SECTION – B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) Simplify the following Boolean expressions to a minimum number of literals using Boolean algebra: **(5×2=10)**

   (i) $AB + A(CD + CD') + A'$

   (ii) $(A + B)'(A' + B')'$

   (b) Given De Morgan's theorem for two variables: $(A \cdot B)' = A' + B'$, prove De Morgan's theorem for three variables by successive substitution. **(10)**

   (c) You are given two numbers: $(305.E)_{16}$ and $(109.6875)_{10}$ **(5×3=15)**

   (i) Convert the given numbers into binary

   (ii) Subtract the later number from the former using binary arithmetic

   (iii) Convert the result of the subtraction into octal

6. (a) How would you implement a one-bit by one-bit binary multiplier using basic gates? **(5)**

   (b) Implement the following Boolean function together with the don't care conditions using only two-input NOR gates (complement of literals are available as input): **(15)**

   $F(A,B,C,D) = \sum(0,1,9,11)$ and $d(A,B,C,D) = \sum(2,8,10,14,15)$

   (c) Given function $F = A'B + BC' + AC$ **(5×3=15)**

   (i) Implement F using AND, OR and NOT gates

   (ii) Minimize F in SOP form using K-Map

   (iii) Implement the minimized F using only NAND gates

Contd P/3

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7. (a) Design the circuit corresponding to the state diagram from Fig. for Q. 7(a), using T flip-flops: **(21)**

   (i) Write the state table

   (ii) Find the input equations for the T flip-flops

   (iii) Draw the circuit diagram

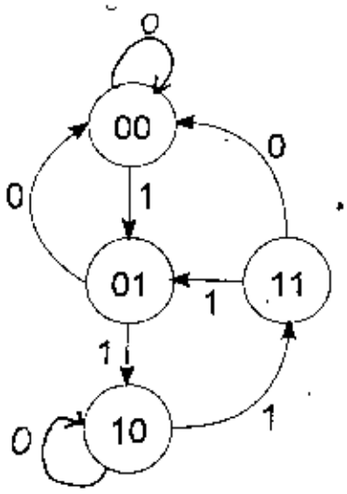

Figure for question 7(a)

   (b) Convert (i) a JK flip-flop into a T flip-flop and (ii) a D flip-flop into a JK flip-flop. **(4×2=8)**

   (c) Draw the block diagrams of Mealy and Moore finite state machines. **(3×2=6)**

8. (a) You have several 32 × 4 ROMs in laboratory. Each ROM can be enabled/disabled using a 1/0 signal respectively. How would you implement a 128 × 4 ROM using the available ROMs? You can use any additional circuitry if needed. **(10)**

   (b) Derive the PLA program table for a combinational circuit that squares a 3-bit binary number. Minimize the number of product terms. **(25)**
