

Noakhali Science and Technology University

Department of Computer Science and Telecommunication Engineering

2nd Year 1st Term B.Sc. (Engg.) Final Examination- July, 2023

Course Code: CSTE 2105

Session: 2020-2021

Course Title: Digital Logic Design

Time: 4 hours.

Total Marks: 70

[Answer any seven of the following questions. Figures in the right hand margin indicate full marks]

1.

- a) Define HA and FA. Derive the expression for sum and carry for both adder types. 3
 b) Explain the operation of a BCD adder circuit that contains two four bit adders and a correction detector circuit. 7

2.

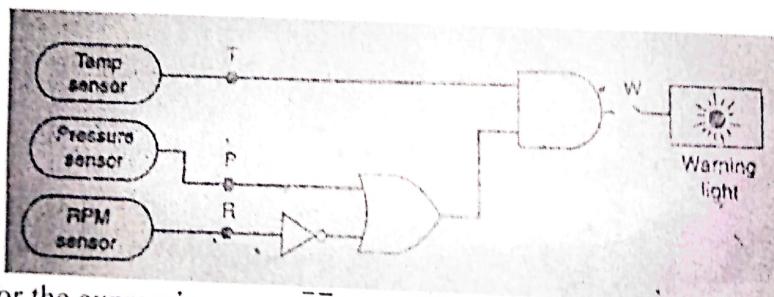
- a) Convert each of the following POS expression to minimum SOP expression Using a Karnaugh-Map: 5

i. $(A+\bar{B})(A+\bar{C})(\bar{A}+\bar{B}+C)$
 ii. $(\bar{A}+B)(\bar{A}+\bar{B}+\bar{C})(B+\bar{C}+D)(A+\bar{B}+C+\bar{D})$

- b) Design and implement a logic circuit that has three inputs, A, B and C, and whose output will be HIGH only when a majority of the inputs are HIGH. 5

3.

- a) Following figure shows a logic circuit that controls a cockpit warning light for certain combination of engine sensors conditions. The HIGH output W activates the warning light. Engine sensors values operate as follows: (i) RPM sensor output=0 only when speed <4800 rpm (ii) P sensor output=0 only when pressure < 220 psi (iii) T sensor output=0 only when temperature < 200°F. Analyze with respect to truth table when the engine will give a warning to the pilot. 4



- b) Draw a K map for the expression $x = \bar{A}\bar{B}C + A\bar{B}\bar{D}$. 3

~~c)~~ Simplify the expression using DeMorgan's theorems = $\overline{\overline{ABC}D}$. 3

4. a) Describe the operation of NOR latch. 5
 b) Compare between clocked J-K FF and clocked S-R FF. 5
 c) Draw the diagram of serial data transfers between X and Y register. 3

5. a) What is the meaning of 50% duty cycle? 2
 b) Design a 50.5% duty cycle clock pulse generator for the given values $C = 0.001 \mu F$ and $R_A + R_B = 102.2 K\Omega$. Find the frequency of the designed clock pulse generator. 5
 c) Generate a signed number with the help of 2's complement addition process using 4 bit parallel adder 74LS283. 3

6.

- a) What is the advantage of a synchronous counter over an asynchronous counter? What is the disadvantage? 2
 b) Explain the mod-16 synchronous up/down counter. 4

- c) Construct a BCD counter that counts 0000 through 1001. Explain its operation with necessary logic diagram and waveforms. 3
7. a) A counter is needed that will count the number of items passing on a conveyor belt. A photocell and light source combination is used to generate a single pulse each time an item crosses its path. The counter must be able to count as many as one thousand items. How many FFs are required? 4
- b) Construct a MOD-60 counter using IC 74LS293. If the input line frequency is 60 Hz, how much frequency produce by MOD-60 counter? 4
- c) How many AND gates are needed to decode a six-bit counter fully? What are the inputs to the decoding gate to produce a HIGH output that decodes for the count of 23? 3
8. a) Compare between multiplexer and demultiplexer. 3
- b) Show how the 74ALS138 decoder can be used as 1 to 8 demultiplexer. 4
- c) Draw the logic circuit of two input multiplexer. 3
9. a) Describe the process of 4 bit digital to analog conversion process. 4
- b) What is the largest value of output voltage from an 8-bit DAC that produces 1.0 V for a digital input of 00110010? 3
- c) A certain semiconductor memory chip is specified as $2K \times 8$. How many words can be stored on this chip? What is the word size? How many total bits can this chip store? 3

Noakhali Science and Technology University

Department of CSTE

Year 2 Term 1, BBA Program, Final Examination 2023

Course Code- HUM 2101, Course Title- Industrial Management and Accountancy

Total Mark - 70

Total Time - 4 Hours

(Answer any seven questions. All parts of a question must be answered sequentially and figures in the right side indicate the marks for each question)

Sl. No	Question	Mark
1.	a) What is your idea about managerial grid? Describe the Maslow's need hierarchy theory of motivation. b) What is strategic leadership? Discuss leadership and power.	5 5
2.	a) Describe internal environment of business organization. b) What do you mean by micro environment? Discuss the micro environment with Michael Porter's 5 forces model.	3 7
3.	a) Suppose you are an employee of Airtel Bangladesh ltd. You have been assigned a task by CEO to analyze your company's environment through using SWOT analysis technique. b) Why a business man has to consider social environment to start/run a business? What are the factors of social environment?	5 5
4.	a) "With the change of the time the features of the business is also changing"- Justify the statement with the description of current features of business. b) "The objective of the business is only to earn profit"- Justify the statement. c) "Globalization is not always congenial"- explain with example.	4 3 3
5.	a) PepsiCo's mission is "To be the world's premier consumer Products Company focused on convenient foods and beverages. We seek to produce healthy financial rewards to investors as we provide opportunities for growth and enrichment to our employees, our business partners and the communities in which we operate. And in everything we do, we strive for honesty, fairness and integrity"- critically analyze this mission statement. b) Differentiate between goal and objective. c) Vision of BSRM is "We at BSRM group aspire to.... <ul style="list-style-type: none"> •□ Maintain our leadership position in the steel industry by producing the best quality steel products, continuously enhancing customer satisfaction and becoming a reliable business partner of our customers and suppliers. •□ Be an employer of choice, with focus on nurturing talent and developing future leaders of the organization. •□ Protect the interest of our shareholders through sustainable growth and value creation. •□ Preserve the trust of all our stakeholders by adopting ethical business practices. •□ Support the society through Corporate Social Responsibility initiatives."- Critically Evaluate this statement 	4 2 4

6.	a) What is management? What are the core functions of management? - Briefly explain. b) What are the management principles given by F.W.Taylor? - Briefly describe those principles.	4 6
7.	a) "Accounting is the language of business". Explain the statement. b) Discuss the importance of accounting for our daily life. c) What are the elements of accounting equation? Define these elements with examples.	2 4 4
8	d) What are the qualitative characteristics of accounting information? Describe those characteristics. e) What is double entry system? Why double entry system is important in accounting?	7 3
9	a) What is the objective of financial statements? What are the components of a complete set of financial statements? Briefly describe each component. b) What are the elements of financial statements? Define each element with example.	5 5

Noakhali Science and Technology University
Department of Computer Science & Telecommunication Engineering
2nd Year 1st Term B.Sc. (Engg.) Final Examination-July, 2023
Course Title: Object Oriented Programming with C++
Course Code: CSTE-2101, Session: 2020-2021

Time: 4 Hours

Full Marks: 70

Answer any seven of the following questions. N.B. Right hand margin indicates marks

- | | | |
|----|--|-----|
| 1. | a) What do you mean by object-oriented programming? Explain the basic principles of object-oriented programming with example. | 2+3 |
| | b) C++ is a superset of C-Explain. | 2 |
| | c) What do you mean by Class and Object? Write the basic structure of a class. | 2+1 |
| 2. | a) What is the application of the scope resolution operator :: in C++? | 2 |
| | b) What is a constructor? Is it mandatory to use constructor in a class? | 1+2 |
| | c) What is wrong with the destructor shown in the following fragment?
<pre>class X{ int a, b, c; public: int ~X(); }</pre> | 2 |
| | d) What is in-line function? Write the advantages and disadvantages of in-line functions. | 1+2 |
| 3. | a) How to return an object from a function? Explain with an example. | 4 |
| | b) What problem is caused by the assignment of ob1 to ob2 of the following class fragment?
<pre>class Test{ int *p; public: Test(int x) { p=(int *) malloc(sizeof(int)); *p = x; } ~Test(){ free(p); } // ... };</pre> | 2 |
| | c) Can the address of an object be passed to a function as an argument? | 1 |
| | d) What is a friend function? Why friend functions are useful? | 1+2 |
| 4. | a) What is the wrong with the constructor shows in the following fragment?
<pre>class sample{ double a, b, c; public: double sample(); };</pre> | 2 |

- b) Create a class called box whose constructor function is passed three double values, each of which represents the length of one side of the box. The box class computes the volume of the box and stores the result in a double variable. Include a member function called vol() that displays the volume of each box object.

4

- c) Write the differences between classes, structures and unions. Explain what an anonymous union is and how it differs from a normal union. Is the following fragment valid?

```
union {
    float f;
    unsigned int bits;
}
```

5. a) What is a reference? What is one advantage of using reference parameter? 1+1
 b) How can a function return a reference? Explain with an example. 3
 c) Is the following fragment valid? If not, why not? 2

```
int &func( );
```

```
.
```

```
.
```

```
.
```

```
int *x;
```

```
x = func( );
```

- d) Given the following class, show how to initialize a ten-element array so that x has the values 1 through 10. 3

```
class Test{
    int x;
    public:
        Test(int n) {x = n;}
        int getx() {return x;}
};
```

6. a) What is function overloading? Explain with an example program. 3
 b) What type of operations will cause the copy constructor to be called? Write the most common general form of a copy constructor. 2+1

- c) What is wrong with the following fragment? 1

```
- class samp {
    int a;
    public :
        samp (int i) { a = i; }
        // ...
    };
    // ...
    int main () {
        samp x, y (10);
        // ... }
```

- d) Explain some ways that ambiguity can be introduced when you are overloading functions. 3

7. a) Why is it necessary to overload an operator? 2
 b) Give a programming example to overload a binary operator by using a member operator function. 4

- c) What is inheritance? What happens when a protected member is inherited as public? What happens when it is inherited as private?
8. a) What is a virtual base class? Why a virtual base class is necessary? 1+1
 When a base class and a derived class both have constructor and destructor functions, what will be the execution order of constructor and destructor functions? Explain with a programming example.
- b) How inheritance helps in code reuse? Implement the following class hierarchy in C++: 4
-
- ```

graph TD
 Shape[Shape] --> TwoD[TwoDimensional]
 Shape --> ThreeD[ThreeDimensional]
 TwoD --> Triangle[Triangle]
 TwoD --> Rectangle[Rectangle]
 TwoD --> Circle[Circle]
 ThreeD --> Box[Box]
 ThreeD --> Cone[Cone]
 ThreeD --> Cylinder[Cylinder]

```
9. a) What is an exception? How is an exception handled in C++? 4  
 b) What are the advantages of using exception handling mechanism in a program? 2  
 c) What is wrong with this following code segment? 2
- ```

try {
// ...
throw 'a';
// ...
}
catch (char *) {
// ...
}
  
```
- d) What will happen if an exception is thrown for which there is no corresponding catch statement? 2

Noakhali Science and Technology University

Department of Computer Science and Telecommunication Engineering

2nd Year 1st Term Final B.Sc. (Engg.) Examination-July, 2023

Course Code: CSTE 2107 Session: 2020-2021 Course Title: Theory of Computation

Time: 4 hours.

Total Marks: 70

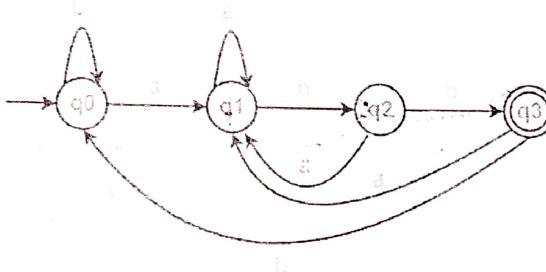
[Answer any seven of the following questions. Figures in the right hand margin indicate full marks]

1. a) What do you mean by theory of computation? Why is automata theory important in computer science? Explain. 1+2=3

b) Show the comparisons among theorem, lemma and corollary with examples. "More flexible memory results to the solution of more computational problems"- do you agree with the statement? Justify your answer accordingly with appropriate diagrams. 2+2=4

c) Define proof by counter-example? Proof that $\sqrt{2}$ is a rational number using proof by contradiction. 1+2=3

2. a) Write down the languages of a DFA and an NFA. Consider the following DFA and show how to process a string *ababba* using extended transition function ($\hat{\delta}$). 2+2=4



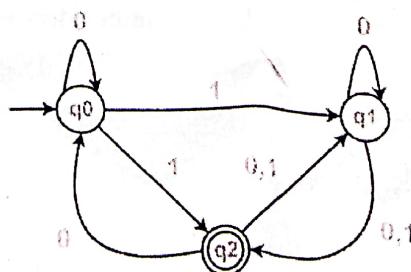
b) Draw a DFA for the following languages over $\Sigma = \{a, b, c\}$: 2+2=4
 (i) The set of all strings with *cbc* is a substring.
 (ii) The set of all strings with equal number of *ab* and *ba*.

c) Construct a moore machine that prints 'a' whenever the sequence '01' is encountered in any binary input string. 2

3. a) Minimize the following DFA using equivalence theorem: 4

	0	1
$\rightarrow q_0$	q_1	q_3
q_1	q_2	q_4
q_2	q_1	q_4
q_3	q_2	q_4
* q_4	q_4	q_4

b) Show the conversion of DFA for the following NFA using subset construction: 4



c) What do you mean by epsilon-closure? What are the uses of ϵ -transitions? 2

4. a) Prove that "If $L=L(A)$ for some DFA A , then there is a regular expression R such that $L=L(R)$ ". 4

- b) Define Arden's theorem. Show the RE for the following DFA using state-elimination 1+3=4

technique:

	0	1
$\rightarrow *p$	s	p
q	p	s
r	r	q
s	q	r

- c) Write down the languages for the REs: (i) $(0(1^*)) + 1$, and (ii) $(01)^* + 1$. 2
5. a) Design the regular expression $(a+b)^*ba^*$ to NFA with ϵ -transitions. 3
- b) Prove that $L = \{0^n10^n \mid n \geq 1\}$ is not a regular language. 4
- c) Show that every regular language is a context free language. 3
6. a) Write down the language of a Pushdown Automata (PDA). Design a PDA to accept a language $L = \{a^i b^j c^k \mid i, j, k \geq 0 \text{ and } i=k \text{ or } j=k\}$. 1+3=4
- b) What is the halting problem and the post correspondence problem? Why they are known as undecidable problems? Explain. 3+1=4
- c) Illustrate P , NP , $NP\text{-hard}$, and $NP\text{-complete}$ classes. 2
7. a) What is derivative tree? Let the grammar $G = (\{S, A, B\}, \{a, b\}, P, S)$. Where P consists of 5
- $$S \rightarrow AC \mid B$$
- $$A \rightarrow a$$
- $$C \rightarrow c \mid BC$$
- $$E \rightarrow aA \mid e$$
- Find an equivalent reduced grammar.
- b) Let the grammar $G = (\{S, A, B\}, \{a, b\}, P, S)$, where P consists of 5
- $$S \rightarrow bA \mid aB$$
- $$A \rightarrow bAA \mid aS \mid a$$
- $$B \rightarrow aBB \mid bS \mid b$$
- Find an equivalent grammar in Chomsky Normal Form (CNF).
8. a) What is Turing Machine? Describe the formal notations of TM in finite automata. 3
- b) Design a turing machine for computing a function $f(x, y) = 2x$. 3
- c) Show the coding rules for the universal turing machine? Differentiate between recursive language and recursively enumerable language. 2+2=4
9. a) What is undecidable problem? 2
- b) Prove that if a language L and its complement \bar{L} are both recursively enumerable, then L (and hence \bar{L}) is recursive. 4
- c) Show that the following problem about programs in a real programming language is undecidable. Whether a given program can loop forever on some input. 4

Department of Computer Science and Telecommunication Engineering
Noakhali Science and Technology University
 B.Sc. (Engineering); Term Final Examination, August'23
 Year-2, Term-1; Session: 2020-2021

Course Code: MATH-2105; Course Title: Matrices, Vector Analysis and Coordinate Geometry

Time: 4 Hours

Marks: 70

(Answer any Seven of the following. The right-hand margin indicates full marks)

No.	Question	Marks	CLOs
1(a)	Define diagonal and tri-diagonal matrix? Give examples.	2	CLO1
1(b)	Find whether the matrix $A = \begin{bmatrix} 2 & 2-3i & 3+5i \\ 2+3i & 3 & i \\ 3-5i & -i & 5 \end{bmatrix}$ is Hermitian matrix or not.	3	CLO1
1(c)	If $A = [a_{ij}]$, where $a_{ij} = \begin{cases} 0, & \text{when } i \neq j \\ C, & \text{when } i = j \end{cases}$ Construct a 3×3 order matrix and identify the type of matrix, where C is the sum of the 1 st digit and the last digit of your ID. Also test the matrix A is (i) orthogonal or not (ii) singular or not	5	CLO1 CLO2
2(a)	Give the matrix and vector representation of the following system of linear equations: (i) $\begin{aligned} x_1 + 2x_2 - 4x_3 + 7x_4 &= 4 \\ 3x_1 - 5x_2 + 6x_3 - 8x_4 &= 8 \\ 4x_1 - 3x_2 - 2x_3 + 6x_4 &= 11 \end{aligned}$ (ii) $\begin{aligned} -x_1 - 2x_2 + 6x_3 &= 11 \\ -5x_2 + 6x_3 - 8x_4 &= 11 \\ -2x_3 + 6x_4 - x_5 &= 11 \\ 2x_4 - 7x_5 &= 200 \end{aligned}$	4	CLO2
2(b)	What is the rank of a matrix? Find the rank of the matrix $X = \begin{bmatrix} 1 & -3 & 2 \\ -2 & 2 & 0 \\ -6 & 9 & -3 \end{bmatrix}$.	6	CLO1
3(a)	Find x, y, z, t using the concept of equality of matrices, where $3 \begin{bmatrix} x & y \\ z & t \end{bmatrix} = \begin{bmatrix} x & 6 \\ -1 & 2t \end{bmatrix} + \begin{bmatrix} 4 & x+y \\ z+t & 3 \end{bmatrix}$.	2	CLO1
3(b)	Solve the following system of linear equations by $\begin{aligned} x + y + z &= 6 \\ x - y + z &= 2 \\ 2x + y - z &= 1 \end{aligned}$ (i) using Cramer rule. (ii) using Gauss elimination. (iii) using matrix method <u>Which method involves fewer computations?</u>	8	CLO3
4(a)	State the Cayley-Hamilton theorem. Verify the theorem for the matrix $A = \begin{bmatrix} 2 & 3 \\ -1 & 4 \end{bmatrix}$ and hence find A^{-1} .	5	CLO3
4(b)	Find the characteristic equation and all the characteristic roots of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 0 & 2 & 3 \\ 0 & 0 & 2 \end{bmatrix}$.	5	CLO3

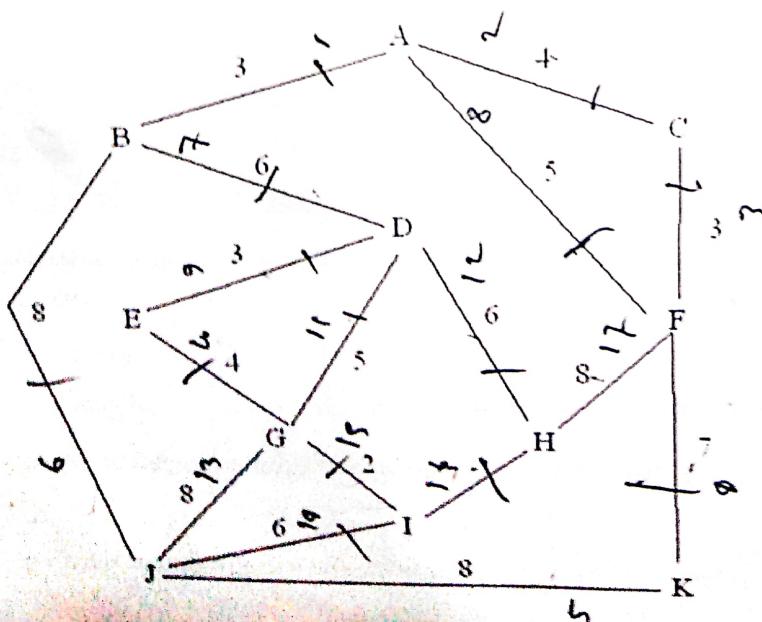
5(a)	Determine the angles α, β, γ which the vector $\vec{A} = 2\hat{i} - 3\hat{j} + \hat{k}$ makes with the positive directions of the coordinate axes. Also show that $\cos^2\alpha + \cos^2\beta + \cos^2\gamma = 1$.	5	CLO4
5(b)	<p>Find a unit vector</p> <ul style="list-style-type: none"> (i) in the direction to the vector $\vec{A} = 2\hat{i} + 4\hat{j} - 5\hat{k}$. (ii) parallel to the resultant of the vectors $\vec{B} = 2\hat{i} + 4\hat{j} - 5\hat{k}$ and $\vec{C} = \hat{i} + 2\hat{j} + 3\hat{k}$. (iii) perpendicular to the plane constructed by the vectors $\vec{D} = 3\hat{i} + \hat{j}$ and $\vec{E} = -\hat{i} + 2\hat{j} + 2\hat{k}$. 	5	CLO4
6(a)	Find a unit normal to the surface $x^2y + 2xz = 4$ at the point $(2, -2, 3)$.	2	CLO4
6(b)	Determine whether the force field $\vec{F}(x, y, z) = x^2y\hat{i} + xyz\hat{j} - x^2y^2\hat{k}$ is a conservative or not.	2	CLO4
6(c)	Verify Green's theorem in the plane for $\oint_C (xy + y^2)dx + x^2dy$, where C is the closed curve of the region bounded by $y = x$ and $y = x^2$.	6	CLO4
7(a)	Determine the equation of the parabola $x^2 - 2xy + y^2 + 2x - 4y + 3 = 0$ after rotating of axes through 45° .	5	CLO4
7(b)	Test the nature of the conic given by the equation $13x^2 - 18xy + 37y^2 + 2x + 14y - 2 = 0$	5	CLO4
8(a)	Find the equation of the plane through the point $(4, 0, 1)$ and parallel to the plane $4x + 3y - 12z + 6 = 0$.	5	CLO4
8(b)	Define shortest distance. Find the equation of the line of shortest distance and length of shortest distance between the lines $\frac{x-2}{1} = \frac{y+3}{2} = \frac{z-5}{4}; \frac{x-5}{2} = \frac{y-2}{3} = \frac{z-7}{5}$.	5	CLO4
9(a)	Define direction cosines and direction ratios. Find the direction cosines of the line which is equally inclined to the axes.	5	CLO4
9(b)	If a line makes angle α, β, γ with the axes then show that $\sin^2\alpha + \sin^2\beta + \sin^2\gamma = 2$	5	CLO4

[Answer any seven of the following questions. Figures in the right-hand margin indicate full marks]

1. a) What do you understand by the best case, worst case and average case scenario of an algorithm? 3
 b) How can we compare between two algorithms written for the same problem? 3
 c) Write the algorithm of Linear search also calculate its complexity. 4
2. a) Give a tight bound of the runtime complexity class for each of the following code fragments in Big-Oh notation, in terms of the variable N . 2+2
- i. int sum = 0;
 for (int i = 1; i <= N - 5; i++) {
 for (int j = 1; j <= N - 5; j = j * 2) {
 sum++;
 }
 }
 System.out.println(sum);
- ii. int sum = N;
 for (int i = 0; i < 1000000; i++) {
 for (int j = 1; j <= i; j++) {
 sum += N;
 }
 }
 for (int j = 1; j <= i; j++) {
 sum += N;
 }
 System.out.println(sum);
- b) // index 0 1 2 3 4 5 6 7 8 9 10 6
 { 16, 21, 45, 8, 11, 53, 3, 26, 49, 31, 12 }

Trace the execution of the quick sort algorithm over the array above, using the first element as the pivot. Show each pass of the algorithm, with the pivot selection and partitioning, and the state of the array as/after the partition is performed, until the array is sorted. You do not need to show details of partitioning calls over ranges of only 1 or 2 elements.

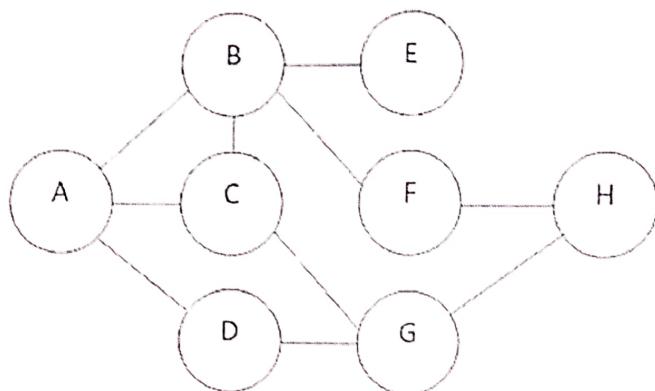
3. a) Consider the graph in the following Figure. Unless otherwise indicated, always visit adjacent nodes in alphabetical order. 5+5



Answer the following:

- Provide the DFS tree starting at node A.
- Use Kruskal's algorithm to derive the MST

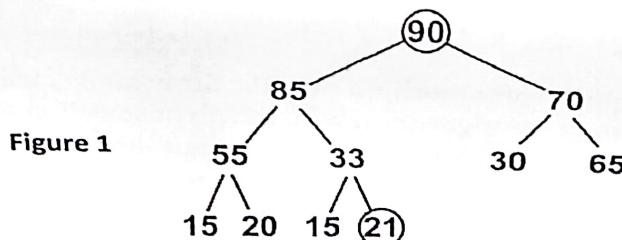
4. a) Starting at vertex A and print the vertices in the order they are processed by DFS. As usual assume the adjacency lists are in lexicographic order, e.g., when exploring vertex F, the algorithm considers the edge F→A before F→G.



- b) Answer True or False. Justify your answer:

- The topological sort of an arbitrary directed graph $G(V;E)$ can be computed in linear time.
- The shortest path between two vertices is unique if all edge weights are distinct.
- An arbitrary graph with $G(V;E)$, with $|E|=|V|$ edges is a tree.

5. a) Consider the heap H in Figure 1, where R = 90 is the root and L = 21 is the last node of the tree. Delete the root R of the tree and show all the steps for reheapifying the tree.



- b) Illustrate the operation of merge sort on the array $A = \{3, 41, 52, 26, 38, 57, 9, 49\}$ and analyze the running time of the algorithm.

- c) Are there any potential drawbacks or limitations to using heap sort?

6. a) Solve the following recurrences by using the master method:

- $T(n) = T(9n/10) + n$
- $T(n) = 7T(n/2) + n^2$

- b) Find the maximum subarray sum for the given input using the divide and conquer approach:

$$-2, 1, -3, 4, \overbrace{-1, 2, 1, -5, 4}$$

What is the running time $T(n)$ for solving this problem?

7. a) Can you explain the basic principles of dynamic programming and how it is used to solve complex problems?
- b) Determine an LCS of $\langle 1, 0, 0, 1, 0, 1, 0, 1 \rangle$ and $\langle 0, 1, 0, 1, 1, 0, 1, 1, 0 \rangle$.
- c) Give an $O(n)$ -time dynamic programming algorithm to compute the n th Fibonacci number.

