Jatiya Kabi Kazi Nazrul Islam University

Dept. of Computer Science and Engineering
2nd Year 2nd Semester Final Examination-2021
**Course: CSE-221 (Algorithms)**

Time: 3 Hours

Full Marks: 5 × 12 = 60

[Answer any five of the following questions]

1. (a) What is algorithm? What are the criteria that an algorithm must satisfy? — 3
   (b) How do you measure algorithmic complexity? Write the differences between "Big O" and "Big Omega" notation? — 1+3
   (c) Define algorithm strategy. List at least five names of algorithmic strategies. — 2
   (d) Solve the following recurrence relation for $a = 1, b = 2$ and $f(n) = c$. — 3
$$T(n) = \begin{cases} T(1) & n = 1 \\ aT(n/b) + f(n) & n > 1 \end{cases}$$

2. (a) Explain divide-and-conquer strategy for algorithm. Write control abstraction of this strategy. — 2+2
   (b) Write the mergesort algorithm to sort n elements using divide and conquer strategy. — 5
   (c) Show the steps of quicksort algorithm for sorting the following sequence 5,15,8,3,4,3,12,10. — 3

3. (a) Find the minimum cost spanning tree of the following graph using Prim's algorithm. Show all the stages. — 3
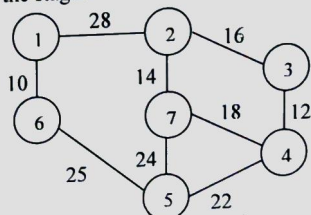

   (b) Write the greedy algorithm to generate the shortest path. — 4
   (c) Find the shortest path from vertex-1 to all destinations of the following graph. — 3
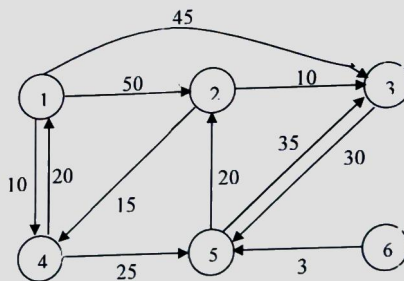
   (d) What do you mean by feasible solution and optimal solution? — 2

4. (a) What is knapsack problem? Consider the following instance of the knapsack problem: $n = 5$, $m = 60$. $(p_1, p_2, ..., p_5) = (30, 40, 45, 77, 90)$, and $(w_1, w_2, ..., w_5) = (5, 10, 15, 22, 25)$. Find the optimal solution of this knapsack problem. — 4
   (b) Briefly describe travelling salesperson problem. State the difference between Dynamic programming and Greedy method. — 1+2
   (c) Write the algorithm of all pair shortest path problem? Calculate the cost matrix A^0, A^1, A^2 and A^3 for the following graph. — 2+3
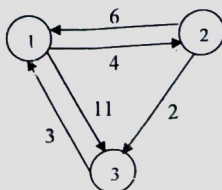
5. (a) Define the terms: Problem state, Solution states, Answer states, State space tree, Live node. Dead node.   3

(b) Find the order of vertices using BFS and DFS and draw the corresponding spanning tree of the following graph.   4
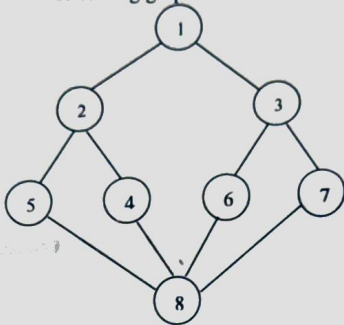

(e) Consider the following directed graph of Figure (a) and its length is given by the matrix Figure (b). Find the optimal tour length and path of the graph.   5
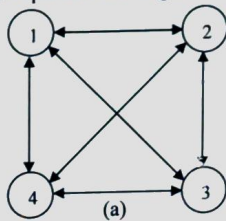
$$\begin{bmatrix} 0 & 10 & 15 & 20 \\ 5 & 0 & 9 & 10 \\ 6 & 11 & 0 & 12 \\ 8 & 8 & 9 & 0 \end{bmatrix}$$

(a)   (b)

6. (a) What is backtracking? State 4-queens problem and draw a solution space of the problem where nodes are numbered in depth first search manner.   4

(b) Consider a sum of subset problem: $n = 4, (w_1, w_2, w_3, w_4) = (11, 13, 24, 6)$ and $m = 30$. Find all possible subsets of w that sum to m. Also, draw the possible solution space organization of this problem and indicate answer nodes.   4

(c) What is vertex-color problem. Write the algorithm of solving vertex-color problem. Explain the algorithm with the following graph.   4
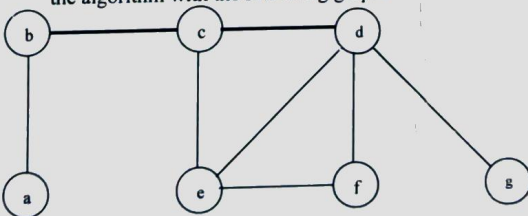
7. (a) Write the basic difference between Backtracking and Branch-and-Bound strategy. Which one is better for 4-queens search problem and why?   2+2

(b) State Least Cost search technique. Write the algorithm of LC search technique.   4

(c) Draw the portion of state space tree generated by FIFO Branch-and-Bound technique for the job sequencing with deadlines instances n=5, $(p_1, p_2, ..., p_5) = (6,3,4,8.5), (t_1, t_2, ..., t_5) = (6,3,4,8,5)$, and $(d_1, d_2, ..., d_5) = (6,3,4,8,5)$. Use variable tuple size formulation to solve this problem.   4

8. (a) Define P, NP, NP-Hard and NP-complete problems with example. Draw an appropriate figure to show the relation among them.   4

(b) State the functions introduced to specify non-deterministic algorithm?   3

(c) Categorize problems according to computing time? State them with example.   3

(d) What is the constraint of dirty sock problem?   2

***** End ****

2

Dept. of Computer Science and Engineering
Jatiya Kabi Kazi Nazrul Islam University
2nd Year 2nd Semester B.Sc (Engg.) Final Examination-2021
Course: CSE-227 (Digital Electronics and Pulse Technique)
Session: 2019-2020

Full Marks: 60

Duration: 3 hours

(Answer any five from the following questions)

01. a) What do you mean by the following terms? **4**
    i)Noise –margin ii) Noise Immunity iii) Propagation delay iv) Fan-out
    b) Using a diode draw a circuit from which you can get HIGH output only when both inputs are HIGH. Explain its operation. **3**
    c) Using a transistor draw a circuit from which you can get LOW output only when both inputs are LOW. Explain the circuit operation. **3**
    d) How can a transistor act as a switch? **2**

02. a) Describe the differences between current sinking and current sourcing action for a logic family. **3**
    b) Explain TTL NAND gate with totem pole output circuit diagram. **4**
    c) Draw basic ECL circuit with emitter followers and explain its operation. **3**
    d) What do you mean by I^2L? **2**

03. a) What are SRAM and DRAM? What are the advantages of SRAMs over DRAMs? **3**
    b) Describe the operation of a CMOS NOR gate with circuit diagram. **4**
    c) What do you mean by LED? Sketch necessary diagrams to show the construction and operation of a LED. **5**

04. a) By means of a timing diagram, show the signals of the outputs f and g in following figure as functions of the three inputs a, b, and c. Use all eight possible combinations of a, b, and c. **2**
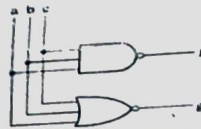
    b) Draw a R/2R ladder Digital-to-Analog converter and derive its voltage equation. What are the advantages of R/2R ladder DAC over binary-weighted resistors DAC? **5**
    c) What do you mean by counter-type ADC? Describe the operation of digital-ramp ADC. **5**

05. a) Draw a pulse and describe its characteristics and from it define duty cycle. **5**
    b) Draw a linearizing circuit for a sweep generator. **2**
    c) Draw and explain the operation of an adder and a subtractor using Op-Amp. **3**

06. a) Draw the block diagram of a 555 timer IC. **3**
    b) Describe how IC 555 timer is used as astable multivibrator, draw the waveforms and derive expression for the frequency. **5**
    c) Draw the circuit diagram of a transistor blocking oscillator and describe its operation. **4**

07. a) Do you think diode is essential electronic device for wave shaping circuit? If yes, prove it. **3**
    b) What is switching circuit? Why are electronic switches preferred to other types of switches? **3**
    c) Draw and discuss a timing circuit using transistor which can be used as a "flip-flop". **3**
    d) Describe the function of a Sample and Hold (S/H) circuit. Why is it important in analog to digital conversion? **3**

08. Write short notes on (any two): **12**

    i) Schmitt trigger ii) PLA's iii) LCD.

Dept. of Computer Science and Engineering
Jatiya Kabi Kazi Nazrul Islam University
B.Sc(Engg.) 2nd Year 2nd Semester Final Exam.— 2021
Session: 2019-2020
Course: CSE 225(Computer Architecture and Organization)

Marks: 60   Time: 3 hours

(Answer any five question from the following)

1. a) What are the main differences between Computer Organization and Architecture? Why we need to learn the basics of Computer Organization and Architecture as a Computer Science and Engineering student? — 4
   b) Draw the structure of IAS computer and explain its components. — 4
   c) Explain different bus interconnection methods. — 4

2. a) Explain the instruction set of Intel 8085 Microprocessor. — 6
   b) Explain cache coherence. — 2
   c) What do you mean by Parallel processing? What are the features of it? — 4

3. a) What are the differences between user programs and supervisor programs? — 3
   b) Discuss about the overlapping instructions in a two-stage instruction pipeline. — 3
   c) What is instruction set? What are the requirements to be satisfied by an instruction set? — 4
   d) When mantissa is said to be normalized? — 2

4. a) Write down the function of the following operation: — 4
      i. Load   ii. Return   iii. Execute   iv. Compare.
   b) Draw and discuss the control signals that implement an addition instruction of the form ADD A,B. — 6
   c) Define vertical microinstruction. — 2

5. a) What do you mean by Bus Arbitration? Explain different bus arbitration method. — 4
   b) What is DMA? Explain DMA technique with suitable diagram. — 4
   c) How we can handle multiple interrupts? — 4

6. a) What is address translation? What are the stages that address translation is carried out? — 4
   b) Discuss about the structure of a dynamic address-translation system. — 4
   c) What are the differences between preemptive allocation and non-preemptive allocation? — 4

7. a) Discuss about a system's interconnection structures. — 4
   b) What is bus arbitration? Discuss about bus arbitration using daisy chaining. — 4
   c) Discuss about programmed IO with separate memory and IO address spaces. — 4

8. a) What are the differences between serial-access memory and random-access memory? — 4
   b) What are the differences between fixed-point and floating-point numbers? — 4
   c) Discuss about the logical structure of four-bit ripple-carry adder. — 4

Department of Computer Science and Engineering
Jatiya Kabi Kazi Nazrul Islam University
2nd year 1st Semester Final Examination— 2021
Course: CSE 223 (Database Management System)
Session: 2019-2020

Time: 3 hours   Marks: 60

(Answer any five questions)

1.
a) Define the terms instance and schema. — 2
b) Write major advantages and disadvantages of a database system. — 4
c) What are the responsibilities of database management system? — 2
d) Explain the different types of database system users. — 4

2.
a) Write down the difference between DDL and DML? — 4
b) List four significant differences between a file-processing system and a DBMS. — 4
c) Describe different state of a transaction. — 4

3.
a) Describe the responsibilities of storage manager? — 4
b) Consider the following expressions, which use the result of a relational algebra — 6
operation as the input to another operation. For each expression, explain in
words what the expression does.

    i. $\sigma_{year \geq 2009}(takes) \bowtie student$

    ii. $\sigma_{year \geq 2009}(takes \bowtie student)$

    iii. $\Pi_{ID,name,course\ id}(student \bowtie takes)$

c) Define agregrate function. — 2

4.
a) Construct an E-R diagram for a bank database having customer, loan, account, — 6
employee and branch as entity types. A customer has an account in a particular
branch of the bank. The customer can also borrow loan from the bank. The bank
has a number of employees working in different branches of the bank. Add
appropriate attributes for each entity type. Represent the key attributes, weak
entity types (if any), cardinality ratios, and role names of each entity type. Make
appropriate assumption to complete the specification.

b) Explain the distinctions among the terms primary key, foreign key, candidate — 6
key and super key.

5.
Consider the bank database. Give an expression in the relational algebra for — 12
each of the following queries.
branch(*branch_name*, branch city, assets)
customer (customer_name, *customer street, customer city*)
loan (*loan_number*, branch name, amount)
borrower (*customer_name, loan number*)
account (*account_number*, branch name, balance)
depositor (*customer_name, account number*)

    i.   Given your choice of primary keys, identify appropriate foreign keys.
    ii.   Find the names of all branches located in "Chicago".
    iii. Find the names of all borrowers who have a loan in branch "Downtown".
    iv. Find the names of all depositors who have an account with a value greater than $6,000 at the "Uptown" branch.
    v.   Find all loan numbers with a loan value greater than $10,000.

6. a) Why **with** clause is needed for any database. 4
   b) Write down a SQL query to **create** and **drop** a table in a database. 4
   c) Write down the responsibility of DBA. 4

7. a) What are the basic domain types in SQL? 2
   b) What is transaction? Explain the ACID properties of the transaction. 5
   c) Define the terms atomicity and durability. Explain the shadow-copy technique 5
      for implementing atomicity and durability.

8. a) Give the differences between superkey and candidate key. 2
   b) What is integrity constraint? Explain different types of constraints on a single 4
      relation.

   c) Consider the following bank database, where primary keys are underlined. Give 6
      an expression in SQL for each of the following queries:
      branch(branch_name, brabch_city, assets)
      customer(customer_name, customer_street, customer_city)
      loan(loan_number, branch_name, amount)
      borrower(customer_name, loan_number)
      account(account_number, branch_name, balance)
      depositor(customer_name, account_number)
      Find the names of ail customers in alphabetic order who have a loan at the
      Perryridge branch.
         (i)   Find the average account balance at each branch.
         (ii)   Find the branch that has the highest average balance.
         (iii)Find all the customers who do have both a loan and an account at the
              bank.

Department of Computer Science and Engineering
2nd year 2nd semester Final Examination-2021
Session: 2019-2020
Course: MATH-275 (Complex variable, Laplace transformation and Fourier analysis)

Full Marks: 60

Time: 3 hours

Answer any five of the following questions

1. a) Define conjugate of a complex number. Express $\frac{(cos\theta + i\,sin\theta)^8}{(sin\theta + i\,cos\theta)^4}$ in the form $x + iy$. — 4

   b) Define modulas of a complex number. For any complex numbers z_1 and z_2, prove that
   $$|z_1 + z_2| \le |z_1| + |z_2|$$ — 4

   c) Find the polar form of the complex number $\left(\frac{2+i}{3-i}\right)^2$. — 4

2. a) Define a complex function. Prove that $\underset{z \to z_0}{Lim}\,[f(z).g(z)] = \underset{z \to z_0}{Lim}\,f(z).\underset{z \to z_0}{Lim}\,g(z)$ — 1+3=4

   b) If $\underset{z \to z_0}{Lim}\,f(z)$ exists, then prove that prove that its value is unique. — 4

   c) If $f(z)$ and $g(z)$ are continuous at z_0, then prove that $f(z) + g(z)$ is continuous at z_0. — 4

3. a) Define analytic function. If $w = f(z) = u(x, y) + i\,v(x, y)$ satisfy the C-R equations $\frac{\partial u}{\partial x} = \frac{\partial v}{\partial y}$ and $\frac{\partial u}{\partial y} = -\frac{\partial v}{\partial x}$ in a region R and partial derivatives $\frac{\partial u}{\partial x}, \frac{\partial v}{\partial y}, \frac{\partial u}{\partial y}$, and $\frac{\partial v}{\partial x}$ are continuous in R, then prove that $f(z)$ is analytic in R. — 1+5=6

   b) Define singular point of a function. Prove that $u = e^{-x}(xsiny - ycosy)$ is harmonic. — 1+2+3=6

4. a) State Green's theorem and verify it for $\oint_c (2xy - x^2)dx + (x + y^2)dy$ where C is the closed curve in the region bounded by $y = x^2$ and $x = y^2$. — 1+5=6

   b) State Cauchy's theorem and prove it for a triangle. — 1+5=6

5. a) If $f(z)$ is analytic inside and on a simple closed curve C and a is any point inside C, Then prove that
   $$f^n(a) = \frac{n!}{2\pi i}\oint_C \frac{f(z)}{(z-a)^{n+1}}\,dz$$ — 6

   b) Prove that all roots of the equation $z^7 - 5z^3 + 12 = 0$ lie between the circles $|z| = 1$ and $|z| = 2$. — 6

6. (a) State and prove Laurents theorem. — 6

   (b) Expand $f(z) = \frac{z}{z^2 + 5z + 6}$ in a Laurent series valid for — 3+3=6

   (i) $2 < |z| < 3$ \qquad (ii) $|z| > 3$

7. a) Define Laplace Transform of a function. Determine the Laplace transforms of $sin(at)$ and $cos(at)$. — 7

   b) If $L\{f(t)\} = F(S)$, then $L\{tf(t)\} = -F'(s) = -\frac{d}{dx}F(S)$. — 5

8. a) Obtain the Fourier series of the function $f(x) = \begin{cases} 0; & -\pi \le x \le 0 \\ 1; & 0 \le x \le \pi \end{cases}$ — 1+5=6

   b) Given that $f(x) = x + x^2$ for $-\pi < x < \pi$, find the Fourier series of $f(x)$ and prove that
   $$\frac{\pi^2}{6} = 1 + \frac{1}{2^2} + \frac{1}{3^2} + \frac{1}{4^2} + \cdots.$$ — 6