University of Dhaka
Affiliated Engineering Colleges
Department of Computer Science and Engineering
1st Year 1st Semester B.Sc. Examination, 2020
CSE – 1102, Discrete Mathematics

Total Marks: 70 Time: 2 Hours

(Answer any 3 (Three) of the following Questions)

1. a) Define Set with example. Prove that $|A_1 \cup A_2| = |A_1 + A_2| - |A_1 \cap A_2|$, where A_1 and A_2 be sets with cardinalities $|A_1|$ and $|A_2|$. 2+5.33
   b) Explain Venn Diagram for Union and Intersection operations where A and B are two sets. 6
   c) Write down the Laws of set theory. 4
   d) Consider Universal set U and two sets A and B. Shade the following sets using Venn Diagram: 6
      i) $A \cap B^C$ ii) $(B/A)^C$

2. a) What is recursion? A function f is defined recursively by f(0) = 3, f(n+1) = 2f(n)+3; Find the value of f(4). 3+3
   b) What is recurrence relation? Obtain the recurrence relation for: 3+6
      $G(k) = 2.4^k - 5.(-3)^k$
   c) Find the solution to the recurrence relation: $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ with the initial conditions $a_0 = 2$, $a_1 = 5$ and $a_2 = 15$ 8.33

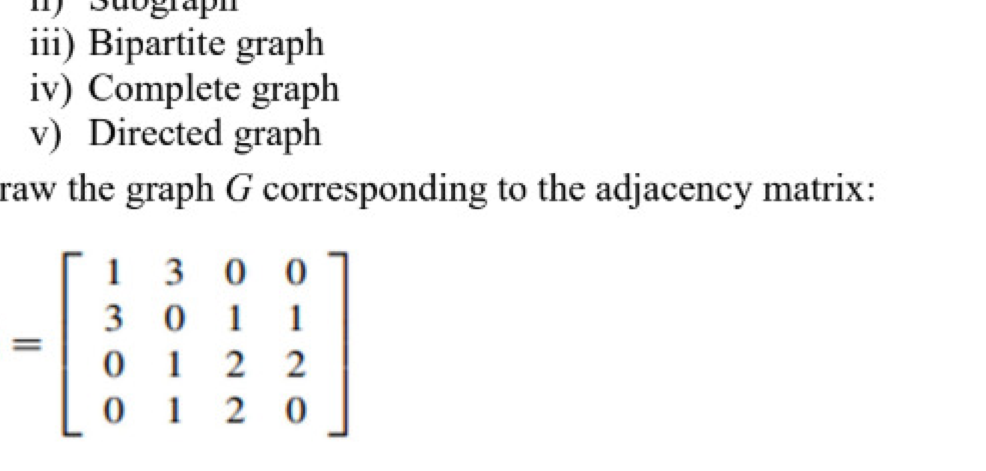
3. a) Define reflexive, symmetric and transitive relation. 6
   b) Consider the following five relations on the set A = {1, 2, 3, 4}: 9
      R = {(1, 1), (1, 2), (2, 3), (1, 3), (4, 4)}
      S = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)}
      T = {(1, 3), (2, 1)}
      U = A × A, the universal relation
      V = ∅, the empty relation
      Determine whether or not each of the above relations on A is
      i) Reflexive ii) Symmetric iii) Transitive
   c) Define Equivalence relation with example. 3.33
   d) Let A = {1,2,3,4}, B = {4,5,6} and C = {6,7,8}. R is a relation from A to B and S is a relation from B to C, which is given by 5
      R = {(x,y): x + y = 7}
      S = {(x,y): y - x = 1}
      Determine R and S.

4. a) State the converse, contrapositive and inverse of the following conditional statements: 6
      i) If it snows tonight, then I will stay at home.
      ii) I go to the beach whenever it is a sunny summer day.
   b) State and proof the Principle of Inclusion and Exclusion. 6
   c) Let A = {1,2,3} and R be the relation, R = {(1,2), (1,3), (2,2), (2,3), (3,3)}. Draw the diagraph by using this relation. 4
   d) Define tautology and contradiction with examples. Verify that $(p \wedge q) \wedge \neg (p \vee q)$ is a contradiction by using truth table. 4+3.33

5. a) Define with figure: 10
      i) Graph
      ii) Subgraph
      iii) Bipartite graph
      iv) Complete graph
      v) Directed graph
   b) Draw the graph *G* corresponding to the adjacency matrix: 3.33

$$A = \begin{bmatrix} 1 & 3 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$

   c) What is isomorphism? Draw two graphs that are isomorphic and describe briefly. 2+4
   d) Represent the graph with an incidence matrix. 4



University of Dhaka
Affiliated Engineering Colleges
Department of Computer Science and Engineering
1st Year 1st Semester B.Sc. Examination, 2020
CSE – 1102, Discrete Mathematics

Total Marks: 70 Time: 2 Hours

(Answer any 3 (Three) of the following Questions)

1. a) Define Set with example. Prove that $|A_1 \cup A_2| = |A_1 + A_2| - |A_1 \cap A_2|$, where A_1 and A_2 be sets with cardinalities $|A_1|$ and $|A_2|$. 2+5.33
   b) Explain Venn Diagram for Union and Intersection operations where A and B are two sets. 6
   c) Write down the Laws of set theory. 4
   d) Consider Universal set U and two sets A and B. Shade the following sets using Venn Diagram: 6
      i) $A \cap B^C$ ii) $(B/A)^C$

2. a) What is recursion? A function f is defined recursively by f(0) = 3, f(n+1) = 2f(n)+3; Find the value of f(4). 3+3
   b) What is recurrence relation? Obtain the recurrence relation for: 3+6
      $G(k) = 2.4^k - 5.(-3)^k$
   c) Find the solution to the recurrence relation: $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ with the initial conditions $a_0 = 2$, $a_1 = 5$ and $a_2 = 15$ 8.33

3. a) Define reflexive, symmetric and transitive relation. 6
   b) Consider the following five relations on the set A = {1, 2, 3, 4}: 9
      R = {(1, 1), (1, 2), (2, 3), (1, 3), (4, 4)}
      S = {(1, 1), (1, 2), (2, 1), (2, 2), (3, 3), (4, 4)}
      T = {(1, 3), (2, 1)}
      U = A × A, the universal relation
      V = ∅, the empty relation
      Determine whether or not each of the above relations on A is
      i) Reflexive ii) Symmetric iii) Transitive
   c) Define Equivalence relation with example. 3.33
   d) Let A = {1,2,3,4}, B = {4,5,6} and C = {6,7,8}. R is a relation from A to B and S is a relation from B to C, which is given by 5
      R = {(x,y): x + y = 7}
      S = {(x,y): y - x = 1}
      Determine R and S.

4. a) State the converse, contrapositive and inverse of the following conditional statements: 6
      i) If it snows tonight, then I will stay at home.
      ii) I go to the beach whenever it is a sunny summer day.
   b) State and proof the Principle of Inclusion and Exclusion. 6
   c) Let A = {1,2,3} and R be the relation, R = {(1,2), (1,3), (2,2), (2,3), (3,3)}. Draw the diagraph by using this relation. 4
   d) Define tautology and contradiction with examples. Verify that $(p \wedge q) \wedge \neg (p \vee q)$ is a contradiction by using truth table. 4+3.33

5. a) Define with figure: 10
      i) Graph
      ii) Subgraph
      iii) Bipartite graph
      iv) Complete graph
      v) Directed graph
   b) Draw the graph G corresponding to the adjacency matrix: 3.33

$$A = \begin{bmatrix} 1 & 3 & 0 & 0 \\ 3 & 0 & 1 & 1 \\ 0 & 1 & 2 & 2 \\ 0 & 1 & 2 & 0 \end{bmatrix}$$

   c) What is isomorphism? Draw two graphs that are isomorphic and describe briefly. 2+4
   d) Represent the graph with an incidence matrix. 4