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| **Scheme of Valuation**(Scheme of evaluation (marks in brackets) and answers of problems/key) |
| **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**V SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018 |
| **Course Code: CS309** |
| **Course Name: GRAPH THEORY AND COMBINATORICS** |
| Max. Marks: 100 |  | Duration: 3 Hours |
| **PART A** |
|  |  | ***Answer all questions, each carries3 marks.*** | Marks |
| 1 |  | Proof- vertices of odd degree in a graph is always even - | (3) |
| 2 |  | Proof- 1.5+1.5 | (3) |
| 3 |  | Difference- 2 markExample for each – 0.5\*2=1 | (3) |
| 4 |  | Dirac’s theorem- 1.5 marksApplicability:Dirac’s condition is not satisfied in the given graph but the graph is having a Hamiltonian circuit - 1.5 marks | (3) |
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| **PART B** |
| ***Answer any two full questions, each carries9 marks.*** |
| 5 | a) | Isomorphism – Def- 2 marksThe given graphs are isomorphic + its proof – 1+2 marks | (5) |
|  | b) | i) n(n-1)/2 = 55 edges -2 marksii) (n-1)/2= 5 edge-disjoint Hamiltonian circuits – 2 marks | (4) |
| 6 | a) | Proof –iff (both directions) – 3+3 marks | (6) |
|  | b) | Sum of degrees of all vertices = 37\*7=259Number of edges = 259/2= 129.5 , this is not an integerSuch an arrangement is not possible - 3marks  | (3) |
| 7 | a) | Any 2 – 1mark \*2  | (3) |
|  | b) | Name of graph- Complete graph of three or more vertices -1 markDefinition of Hamiltoninan circuit with an example– 2 marksDraw a graph that has a Hamiltonian path but does not have a Hamiltonian circuit – 1 mark | (3) |
|  | c) | Proof – 3 marks | (3) |
|  |  |  |  |
| **PART C** |
| ***Answer all questions, each carries3 marks.*** |
| 8 |  | show that distance satisfies all the three conditions of a metric:nonnegativity, symmetry, triangle inequality- 3 marks | (3) |
| 9 |  | i) eccentricity and center –finding – 2 marksii)nn-2, 5048 number of labelled trees possible – 1 mark | (3) |
| 10 |  | simplest non-planar graphs – Kuratowski’s first and second graphs – draw it-1 marks , Properties – 2 marks | (3) |
| 11 |  | Condition: Hint- There is a 1 to 1 correspondence between the edges in G1 and edges in G2 such that a set of edges in G1 forms a circuit iff the corresponding set in G2 forms a cut set – 1 markProof- 2 marks  | (3) |
|  |  |  |  |
| **PART D** |
| ***Answer any two full questions, each carries9 marks.*** |
| 12 | a) | Construction of dual- 2 marksProperties- 4 marks | (6) |
|  | b) | Rooted tree with example -3 marks | (3) |
| 13 | a) | Rank = n-1 ,nullity = e-n+1 so number of vertices =7, number of edges = rank+ nullity= 14 (1+1 marks) | (2) |
|  | b) | Proof- 4 marks | (4) |
|  | c) | binarytree with minimum weighted path length. | (3) |
| 14 | a) | Definition + eg- 2 marks Application – identifying vulnerable or week network areas - 2 marks  | (4) |
|  | b) | Spanning tree-Definition.- 1 marksProof- 4 marks  | (5) |
| **PART E** |
| ***Answer any four full questions, each carries10 marks.*** |
| 15 | a) | flow chart of spanning tree algorithm including conditions  | (6) |
|  | b) | Cut set matrix construction-4 marks | (4) |
| 16 | a) | flowchart of connectedness and components algorithm | (6) |
|  | b) | Def-adjacency matrix – 2marksGraph construction – 4 marks | (4) |
| 17 | a) | Explain- 2+ 2 marks | (4) |
|  | b) | Proof- 6 marks | (6) |
| 18 | a) | Algorithm- 5 marksShortest path between a-z = a-c-b-d-zPath length= 2+1+5+6=14 (5 marks) | (6) |
|  | b) | Proof – 4 marks (Idea: Consider i-th row in A and j-th row in B. If i-th vertex is in j-th circuit, dot product is 0, else dot product will be 1+1=0(mod2) ) | (4) |
| 19 | a) | Def- cut-set matrix- 2 marksAny 4 properties -3 marks | (5) |
|  | b) | Spanning tree edges: (d—f),(a—b),(b—f),(d—e),(d—c) , path length= 9Note: **other set of edges with same path length is possible** | (5) |
| 20 | a) | Proof-5 marks | (5) |
|  | b)  | Explain- 2 marksExample- 2 marksSame storage- 1 mark | (5) |
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