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| Description: T:\106 ADMIN - INSTRUCTIONS\AD 106.3 FORMS BCC\Logos\New BCC Logos\Logos for Staff Use\For Printing Purposes\Ballajura College Logo CMYK less than 5cm.jpg | **Mathematics Applications**  **Unit 3 Year 12 2023**  **Test 3: Calculator Free** | |  |
| Working Time: 20 minutes | | Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
| No notes or calculators permitted | | | |
| 1. (3, 3, 3: 9 marks) | | | |
| 1. The following bipartite graph shows the subjects studied by three students. Redraw the graph to clearly show the two sets of vertices and hence state which vertices represent the subjects studied. | | | |
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| 1. The complete bipartite graph denoted by has vertices in one set and vertices in the other set. 2. Draw and state whether the graph is Eulerian, semi-Eulerian or neither.   Justify your choice.   1. Draw and state whether the graph is Hamiltonian, semi-Hamiltonian or neither. Justify your choice. | | | |

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| 1. (1, 1, 1, 1: 4 marks) | |
| For the graph shown below; | |
| 1. Determine the degree of each vertex 2. State the number of edges 3. State the number of faces |  |

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| 1. If the graph is planar, redraw the graph   with no intersecting edges |

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| 1. (2, 1, 1, 2: 6 marks) | |
| A tree graph is a planar graph with no cycles. It is an undirected graph in which any two vertices are connected by exactly one path. The following questions all refer to tree graphs.  a) For the following trees state the number of vertices and the number of edges. | |
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| b) Draw a semi-Eulerian tree with 4 vertices and 3 edges.  c) Is it possible to draw a tree with 4 vertices and 5 edges?  d) Use Euler’s formula to justify why tree graphs, with vertices, are all planar. | |

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| 1. (2, 2, 2: 6 marks) |
| Classify the following graphs as;   1. Eulerian (E) or semi-Eulerian (SE), 2. Hamiltonian (H) or semi-Hamiltonian (SH) or 3. no classification (N).  |  |  | | --- | --- | | Graph | Classifications | |  |  | |  |  | |  |  | |

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| Description: T:\106 ADMIN - INSTRUCTIONS\AD 106.3 FORMS BCC\Logos\New BCC Logos\Logos for Staff Use\For Printing Purposes\Ballajura College Logo CMYK less than 5cm.jpg | **Mathematics Applications**  **Unit 3 Year 12 2023**  **Test 3: Calculator Assumed** | |  |
| Working Time: 30 minutes  Calculators and ½ page of notes permitted | | Student Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | |
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| 1. (3, 3, 2: 8 marks) | | | |
| The vertices in the graph below represent city landmarks and the weights on the edges are the times, in minutes, to travel between adjacent landmarks.     1. Determine the shortest time to travel from *A* to *H*, stating the route used. 2. The travel times from *A* to *B* and from *G* to *H* both increase by 4 minutes. Explain how these changes affect your answer to part a above. 3. Construct the adjacency matrix for the subgraph below; | | | |

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| 1. (1, 1, 1, 2, 2, 1: 8 marks)   Two road network systems are shown below. Network One is in table form and Network Two is in graph form.  Network One Network Two     |  |  |  |  |  | | --- | --- | --- | --- | --- | |  | **A** | **B** | **C** | **D** | | **A** | 0 | 2 | 0 | 1 | | **B** | 1 | 1 | 0 | 1 | | **C** | 0 | 0 | 0 | 0 | | **D** | 0 | 2 | 1 | 0 | |
| 1. Based on the values in the table, explain why Network One is a directed graph. 2. Explain why Network Two can be classified as a planar graph. 3. Use Network Two to describe a closed walk of length 5 4. When the adjacency matrix for Network One is squared the value in Row 1, Column 2 is 4. Explain the meaning of this value. 5. Draw a subgraph of Network One containing only the vertices A, C and D. 6. Determine where a bridge exists in Network One |

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| 1. (3 marks) |
| Consider the following undirected graph.    There are 5 walks from A to A of length 2. These walks are: A-B-A via the top path, A-B-A via lower path, A-B-A as a loop in one direction, A-B-A as a loop in the other direction and A-C-A.  Complete the table below to show how many walks of length 2 there are between vertex E and the other vertices in the graph.  To  From   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | |  | **A** | **B** | **C** | **D** | **E** | | **A** | *5* | *0* | *0* | *3* | *0* | | **B** | *0* | *5* | *3* | *0* | *2* | | **C** | *0* | *3* | *2* | *0* | *2* | | **D** | *3* | *0* | *0* | *6* | *0* | | **E** |  |  |  |  |  | |

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| 1. (1, 2, 2: 5 marks) |
| A clothing company owns a warehouse and 6 outlet stores.  The network below shows the location of the warehouse**.**  The warehouse supplies clothing to six outlet stores, **.**  The numbers along the edges indicates the kilometres of connecting roads.     1. A delivery van is at store B. It must make a delivery to store E before returning to the warehouse. Determine the minimum distance travelled on this journey. 2. A salesman wants to leave the warehouse and visit every store once before returning to the warehouse. Describe a route he could take and state the mathematical term used to describe this route. 3. The owner of the company wants to check for competitors along the streets of this network describe a route she could take and state the mathematical term used to describe this route. |

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| 1. (3 marks) |
| If the shortest path from start to finish is 9 km, state all possible values for and and the possible shortest path. |

TEST 3 STUDY TOPICS Test Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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| **Graph Terminology** | | | **Types of Graphs** | | |
| * Graph * Vertex * Edge * Arc * Bridge * Path (open/closed) * Cycle | * Network * Degree of vertex * Loop * Face * Walk (open/closed) * Trail (open/closed) | | * Simple graph * Complete graph * Digraph * Planar graph * Tree | | * Subgraph * Connected graph * Bipartite graph * Weighted graph |
| * Eulerian graph * Eulerian trail * Semi-Eulerian graph * Semi-Eulerian trail | | | * Hamiltonian graph * Semi-Hamiltonian graph | | |
| * Construct an adjacency matrix from a graph or digraph | | * Apply Euler’s formula | | * Determine Shortest Path in a weighted graph | |

Creelman Revision Guide;

Graph theory: Chapter 10

Shortest path: Chapter 11

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| Graph Terminology & Types of Graphs | | | |
| Eulerian | | Hamiltonian | |
| Adjacency matrix | Euler’s formula | | Determine Shortest Path |