**Stage 2 GENERAL MathematicS**

**Assessment Type 1: Skills and Applications Tasks**

**TOPIC 5: DISCREET MODELS (Practice Test)**

**Purpose**

To demonstrate your ability to:

* understand mathematical concepts and relationships from within Topic 5: Discreet Models
* select and apply mathematical techniques and algorithms to find solutions to problems
* interpret results, draw conclusions, and consider the reasonableness of solutions in context
* communicate mathematically and present mathematical information.

This assessment allows you to show your skills in understanding and appropriate use of the mathematical concepts, process, and strategies in the following:

1. Subtopic 5.1: Critical Paths
2. Subtopic 5.2: Assignment Problems

**Assessment Conditions**

This is a supervised assessment.

This task is conducted in a 90 minute lesson.

**Assessment Design Criteria**

**Concepts and Techniques**

CT 1 Knowledge and understanding of concepts and relationships.

CT 2 Selection and application of mathematical techniques and algorithms to find solutions to problems in a variety of contexts.

**Reasoning and Communication**

RC 1 Interpretation of mathematical results.

RC 2 Drawing conclusions from mathematical results with an understanding of their reasonableness and limitations.

RC 3 Use of appropriate notations representations and terminology.

The owners of a farm of the outskirts of Goolwa want to change their main stock from cattle to alpacas. These animals have a number of different requirements to cattle, so changes must be made to the fences, watering points, laneways and some of the sheds. The planning and completion of the project will take several months and must be timed precisely.

The network diagram below shows the sequence of the jobs that have to be done to get the property ready for the arrival of the alpacas. The times are given in weeks (eg. J-6 refers to task J taking 6 weeks to complete.)

**A-2**

**H-3**

**S - 3**

**D-6**

**G-2**

**F-5**

**J-6**

**R - 3**

**M-6**

**L-6**

**B-4**

**I-5**

**K-1**

**Q - 3**

**P-5**

**O-9**

**N-8**

**C-1**

**E-2**

**start**

**finish**

1. List all the jobs that must be completed before job P can begin (1 mark)

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1. Using the network diagram above:
   * 1. find the minimum completion time for the total preparation of the farm and write your answer below (2 marks)

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* + 1. Clearly mark the critical path, and explain why you know it is the critical path (2 mark)

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1. Slack time:
   * 1. Calculate the slack time for task L of the preparation. (1 mark)

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* + 1. What information does the slack time in task L provide? (1 marks)

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1. After consultation with some alpaca experts, it becomes clear that some of the planned stages of the preparation are either unnecessary or can be reduced in time. Task F is no longer necessary, and the time to complete task N has now been halved. The revised network is shown below.

**A-2**

**H-4**

**S-3**

**D-6**

**G-2**

**F-5**

**J-6**

**R-3**

**M-6**

**L-6**

**B-4**

**I-5**

**K-1**

**Q-3**

**P-6**

**O-9**

**N-8**

**C-1**

**E-2**

**N-4**

* + 1. Find the new critical path and the new minimum completion time (2 marks)

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* + - * 1. State one limitation that could affect the reliability of the minimum completion times found in this question. (1 mark)

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A new community sports centre is to be built. The main activities and prerequisites can be summarised as follows:

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| **Label** | **Activity** | **Prerequisites** |
| A | Discuss needs with potential users | - |
| B | Obtain community approval | A |
| C | Prepare Design Brief | B |
| D | Establish Budget | B |
| E | Consult with Community | C |
| F | Complete Documentation | C D |
| G | Obtain Financing | C D |
| H | Call and obtain tenders | E F |
| I | Select Contractor | H G |

Draw a network for the project (5 marks)

A school is holding a Dinner as a fundraiser. Some home groups have agreed to help set up the hall during the afternoon before the event. The home groups are 8A, 8B, 9A and 9B. The tasks that must be completed to set up for the function are: relocating chairs to each table, table decoration, streamers and balloons, and kitchen setup. The table below gives the time in minutes that is needed by each home group to complete the tasks.

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| Homegroup | Chair Relocation | Table Decoration | Streamers/balloons | Kitchen setup |
| 8A | 19 | 15 | 20 | 16 |
| 8B | 32 | 20 | 25 | 15 |
| 9A | 21 | 20 | 23 | 14 |
| 9B | 29 | 20 | 32 | 20 |

1. Interpret the meaning of ‘14’ in the table above (1 mark)

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* + - * 1. Which home group uses the **minimum** amount of time to set up the kitchen? (1 mark)

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1. Determine the most time efficient way to use the home groups to set up for the Dinner. (Show all your working.) (6 marks)

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ASIO is appointing secret agents to its specialist units: the Terrorism unit, Infiltration unit, and the Communications unit. The available agents are Leonardo, Brad, Nicole and Angelina. The table below shows the number of years’ experience each agent has had in each area of expertise.

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| Agents | Terrorism | Infiltration | Communications |
| Leonardo | 9 | 7 | 3 |
| Brad | 1 | 6 | 7 |
| Nicole | 4 | 5 | 0 |
| Angelina | 0 | 3 | 9 |

The agents will be allocated to units so that the total number of years’ experience is **maximised**

1. Which agent is the most experienced in Communications? (1 mark)

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1. State the maximum value in the table (1 mark)

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1. Write down the matrix that the Hungarian Algorithm must be applied to (3 marks)

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1. Assign each unit to an agent so that the total number of years’ experience is maximised (6 marks)

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1. Which agent did not get assigned a unit? (1 mark)

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Performance Standards for Stage 2 General Mathematics

|  | Concepts and Techniques | Reasoning and Communication |
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| A | Comprehensive knowledge and understanding of concepts and relationships.  Highly effective selection and application of mathematical techniques and algorithms to find efficient and accurate solutions to routine and complex problems in a variety of contexts.  Successful development and application of mathematical models to find concise and accurate solutions.  Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems. | Comprehensive interpretation of mathematical results in the context of the problem. Drawing logical conclusions from mathematical results, with a comprehensive understanding of their reasonableness and limitations.  Proficient and accurate use of appropriate mathematical notation, representations, and terminology.  Highly effective communication of mathematical ideas and reasoning to develop logical and concise arguments.  Formation and testing of appropriate predictions, using sound mathematical evidence. |
| B | Some depth of knowledge and understanding of concepts and relationships.  Mostly effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine and some complex problems in a variety of contexts.  Attempted development and successful application of mathematical models to find mostly accurate solutions.  Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems. | Mostly appropriate interpretation of mathematical results in the context of the problem. Drawing mostly logical conclusions from mathematical results, with some depth of understanding of their reasonableness and limitations.  Mostly accurate use of appropriate mathematical notation, representations, and terminology.  Mostly effective communication of mathematical ideas and reasoning to develop mostly logical arguments.  Formation and testing of mostly appropriate predictions, using some mathematical evidence. |
| C | Generally competent knowledge and understanding of concepts and relationships.  Generally effective selection and application of mathematical techniques and algorithms to find mostly accurate solutions to routine problems in different contexts.  Application of mathematical models to find generally accurate solutions.  Generally appropriate and effective use of electronic technology to find mostly accurate solutions to routine problems. | Generally appropriate interpretation of mathematical results in the context of the problem. Drawing some logical conclusions from mathematical results, with some understanding of their reasonableness and limitations.  Generally appropriate use of mathematical notation, representations, and terminology, with reasonable accuracy.  Generally effective communication of mathematical ideas and reasoning to develop some logical arguments.  Formation of an appropriate prediction and some attempt to test it using mathematical evidence. |
| D | Basic knowledge and some understanding of concepts and relationships.  Some selection and application of mathematical techniques and algorithms to find some accurate solutions to routine problems in context.  Some application of mathematical models to find some accurate or partially accurate solutions.  Some appropriate use of electronic technology to find some accurate solutions to routine problems. | Some interpretation of mathematical results. Drawing some conclusions from mathematical results, with some awareness of their reasonableness.  Some appropriate use of mathematical notation, representations, and terminology, with some accuracy.  Some communication of mathematical ideas, with attempted reasoning and/or arguments.  Attempted formation of a prediction with limited attempt to test it using mathematical evidence. |
| E | Limited knowledge or understanding of concepts and relationships.  Attempted selection and limited application of mathematical techniques or algorithms, with limited accuracy in solving routine problems.  Attempted application of mathematical models, with limited accuracy.  Attempted use of electronic technology, with limited accuracy in solving routine problems. | Limited interpretation of mathematical results. Limited understanding of the meaning of mathematical results, their reasonableness or limitations.  Limited use of appropriate mathematical notation, representations, or terminology, with limited accuracy.  Attempted communication of mathematical ideas, with limited reasoning.  Limited attempt to form or test a prediction. |