**Stage 2 General Mathematics**

**Assessment Type 2: Mathematical Investigation**

**Topic 2: Modelling with Matrices**

**Introduction**

In this task you are going to use the properties of Matrices to help you rank the performance of contestants in a competition. This will enable you to make predictions about who should perform well in future games.

**Investigation**

1. Select or design a short simple game for two players in which skill, strength, or experience play an important part in determining the outcome of the contest. The game cannot be based on chance (e.g. the toss of a coin).

(Note: Do not waste time on selecting or designing the game as the activity is not critical to the mathematics of the project).

1. Choose a group of at least 6 people and play 4 rounds of a Round Robin tournament leaving the last 2 rounds incomplete. (A Round Robin competition has each person playing every other person once only.)

*(Where possible, Step 2 should be completed within one lesson.)*

1. Record the results in a table. Convert this table to a network and then into matrix form. (i.e. create matrix *D*.)
2. Calculate *D*2, *D*3, and possibly *D*4. Use to rank the players at this stage of the competition. Choose different values of *a*, *b*, *c*, and *d*, with justification, and recalculate *S* twice more to find *S*2 and *S*3. Do the rankings change for each calculation of *S*? If *c* = *d* = *0* would the rankings be any different?
3. Make predictions for the remaining games in the competition based on each of *S*1, *S*2, and *S*3.
4. Play the remaining rounds of the competition and record the results.
5. Comment on the accuracy of your predictions. Which matrix *S* gave the best predictions? If no matrix *S* gave very accurate predictions what does this suggest about the skill factor of your contest? Would another formula for *S* have given closer predictions? Comment on the usefulness of this method for predicting future results.

**Conclusion**

Using your results from above summarise your findings.

Comment on how accurately your model relates to a real situation. Look carefully for similarities and differences.

**The investigation report should be a maximum of 12 single-sided pages if written, or the equivalent in multimodal form.**

A completed investigation should include:

* an introduction that outlines the problem to be explored, including it significance, its features, and the context
* the method required to find a solution, in terms of the mathematical model or strategy to be used
* the appropriate application of the mathematical model or strategy, including
* the generation or collection of relevant data and/or information, with details of the process of collection
* mathematical calculations and results, and appropriate representations
* the analysis and interpretation of results
* reference to the limitations of the original problem
* a statement of the results and conclusions in the context of the original problem.

Performance Standards for Stage 2 General Mathematics

| - | Concepts and Techniques | Reasoning and Communication |
| --- | --- | --- |
| 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. |