**Stage 2 General Mathematics**

**Assessment Type 2: Mathematical Investigation**

**Modelling with Matrices**

**Using data from a sporting context to rank teams**

Dominance matrices can be useful in round robin sporting competitions. The dominance model can be used to make predictions based on current season performances about which team might win a competition. You will choose a sport or competition played in a ‘round robin’ format where results can be easily obtained for a completed season so the final ranking of the teams is known.

(Note: the word ‘round’ can be used in many senses in sports, however in this task the term ‘round’ is taken to mean that each team has played every other team once.)

1. Choose the sport for which you will be using dominance matrices to make predictions about the outcomes of the season. Some suggestions of sports leagues you could consider are: SANFL, NBA, Australian Netball League or Hyundai A-League soccer. (Note: Competitions in which there are large numbers of teams will mean very large matrices. If a competition that has a smaller number of participating teams cannot be found or you wish to investigate a larger competition, you should select a subset of the teams from which to collect data – e.g. from all of the AFL competition you could collect data for eight of the teams.)
2. Gather results for your chosen sport for the first complete round of games. Some websites which provide data for specific sports are given below:

<https://en.wikipedia.org/wiki/2015_SANFL_season>

<http://www.scorespro.com/basketball/australia/nbl/2014-2015/results/>

<http://www.a-league.com.au/results/214/2015/2319/1>

1. Select three games at random to be removed from the data (i.e. assume these games are yet to be played). Create a dominance matrix from the rest of the results. Explain how you have represented win/loss (and draws if necessary) in your dominance matrix.
2. Use your dominance matrix to rank the teams on the results so far and make predictions about the outcomes of the three games yet to be played. Discuss the usefulness and limitations of using the dominance matrix alone for making these predictions and make a comparison with what actually happened.
3. Discuss second and third order influences and their significance. Choose a supremacy model to use with your data and compare its predictions to those made for the three games yet to be played in part 4.
4. Use your supremacy model to make a prediction of the final ladder placings of all the teams in your sample. Compare your result with the actual ranking at the end of the season and discuss the result.
5. Investigate ways of refining your dominance model which might improve the predictions made. You could consider:
   * different supremacy models
   * adding further game outcomes to the dominance matrix
   * some way of incorporating winning margins
6. For at least one of the investigations in part 7, form and test a prediction.

Students are required to make and test predictions based on the mathematics that they are using to model the problem.

In the process of forming and testing predictions, students will need to:

* + State the prediction
  + Test the prediction mathematically
  + Discuss the outcome of testing the prediction.

To reach the A grade band for RC5, students need to form and test more than one appropriate prediction.

1. Using your results from above, summarise your findings. Comment on how accurately your models relate to the real situation. Discuss and limitations of the models, and the reasonableness of the solutions found.

**The investigation report should be a maximum of 12 single-sided A4 pages if written, or the equivalent in multimodal form.**

**Report Format**

The report may take a variety of forms, but would usually include the following:

* an outline of the problem and context
* the method required to find a solution, in terms of the mathematical model or strategy used
* the application of the mathematical model or strategy, including
* relevant data and/or information
* mathematical calculations and results using appropriate representations
* discussion and interpretation of results, including consideration of the reasonableness and limitations of the results
* the results and conclusions in the context of the problem.

A bibliography and appendices, as appropriate, may be used.

The format of an investigation report may be written or multimodal.

**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. |