VCE General Mathematics Unit 4

Area of Study 2 Networks and decision mathematics module sample modelling or problem-solving task: Planning a campaign

The modelling or problem-solving task is to be of 2–3 hours’ duration over a period of one week.

Introduction

An election has been called and several candidates are planning their campaign. Students could work with real data from the [AEC](https://www.aec.gov.au/Electorates/maps.htm) or [VEC](https://www.vec.vic.gov.au/electoral-boundaries/download-boundary-maps) electorate within which they live.

Particular elements for networks to be analysed can be chosen according to a common set of specifications, for example the range and number of localities, venues/events to be visited and tasks to be undertaken.

Part 1

Candidates plan to tour towns/suburbs in their electorate using a network.

1. For a candidate to visit all the towns/suburbs in their electorate, determine the type of travel situation encountered – walk, trail, path circuit or cycle.
2. A candidate operates from an office as a campaign base, requiring a circuit or a cycle for their tour. Determine whether this is possible for their electorate, and the shortest distance to be travelled to visit the towns/suburbs.
3. A candidate has volunteer helpers living in each town/suburb. Find the shortest network linking all of these helpers.
4. From time to time issues arise which require a candidate to make a special visit to a location, venue or event from where their office is based. Consider several such visits and find the shortest trip for the candidate to travel from their base to the location.

Part 2

The management of the campaign requires the completion of a number of tasks and the campaign manager has set up a directed network that outlines required activities. Related to the given context, consider a suitable scenario for this.

1. Find the EST and/or LST for activities in this network.
2. Find the activities, in order, on the critical path length for this network, and determine the total time required to complete all tasks.
3. Changes in circumstance may require a particular step not on the critical path to be completed before another step; and additional resources may become available. Analyse how these variations affect the overall completion of tasks.

Part 3

Volunteers assist in a range of ways and need to be able to do several jobs to get things done. For example, at a given stage in the campaign, there may be four volunteers helping a candidate and four key tasks to be completed. Related to the given context, consider a suitable scenario for this.

1. Initially, the volunteers are limited in what they can do, based on their existing experience and expertise. Draw up a bipartite graph to show how the tasks are completed by the volunteers.
2. As the campaign progresses, the volunteers develop their experience and expertise further, and each are able to perform all key tasks, but with different levels of proficiency. Determine the most effective allocation of volunteers to tasks.
3. Consider the effect of change in the range of tasks required, and/or the capacity of volunteers to carry out these tasks, on their effective allocation.

Areas of study

The following content from the areas of study is addressed through this task.

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| **Unit 4** | | |
| **Area of study** | **Topics** | **Content dot points** |
| Discrete mathematics | Graphs and networks  Exploring and travelling problems  Trees and minimum connector problems  Shortest path problems  Matching problems  The scheduling problem and critical path analysis | 1, 2  1, 2, 3  1, 2, 3  1, 2  1, 2  1, 3 |

Outcomes

The following outcomes, key knowledge and key skills are addressed through this task.

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| **Unit 4** | | |
| **Outcome** | **Key knowledge dot point** | **Key skills dot point** |
| 1 | 1, 2, 3, 5, 6, 7 | 1, 2, 3, 5, 6, 7 |
| 2 | 1, 2, 3, 4 | 3, 4 |
| 3 | 1, 2, 3, 4, 5, 7 | 1, 3, 4, 5, 9, 10, 11, 12 |