9.1 Defining the Problem

Your first task is to identify a topic for your project. Your topic needs to be of interest to you personally. It must also involve sufficient mathematical content and analysis to constitute a reasonable culminating project. Conversely, the problem cannot be so large that a reasonable analysis using the skills and knowledge from this course is impossible.

There are many ways to get started on your topic search. Some possible sources for ideas include:

- A social issue of interest to you
- A sport or hobby that you enjoy
- An issue from another course you would like to investigate
- An interesting article from a newspaper
- A question or issue from this textbook you want to investigate further
- A smaller project from this textbook which could be expanded
- An interesting issue from the Internet or other media
- An issue arising from employment or a possible future career
- An issue generated through brainstorming with others

Using Mind Maps to Identify or Refine a Problem

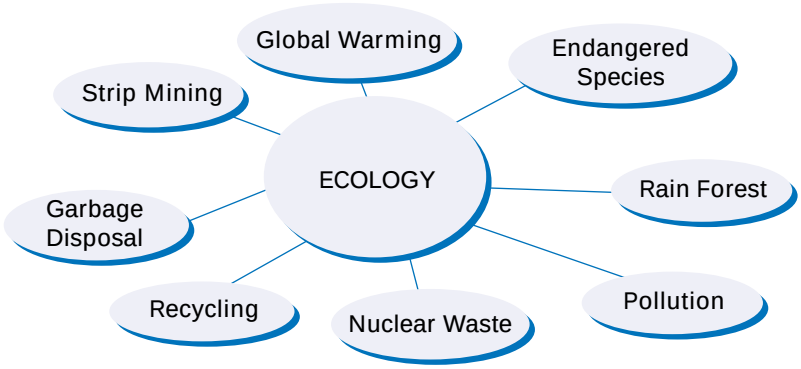
A useful tool for generating and organizing related topics is called a **mind map**. A mind map begins with a broad, general topic and generates sub-topics related to the main theme.

Example 1 **First Level Mind Map**

For the main topic ECOLOGY, construct a mind map showing sub-topics Pollution, Global Warming, Endangered Species, Rain Forest, Recycling, Nuclear Waste, Strip Mining, and Garbage Disposal.

Solution

A mind map for this topic is shown below.



Mind maps typically have several levels. Each level flows from the level above it. The magnitude of the topics at each level is smaller than the previous level.

WEB CONNECTION

www.mcgrawhill.ca/links/MDM12

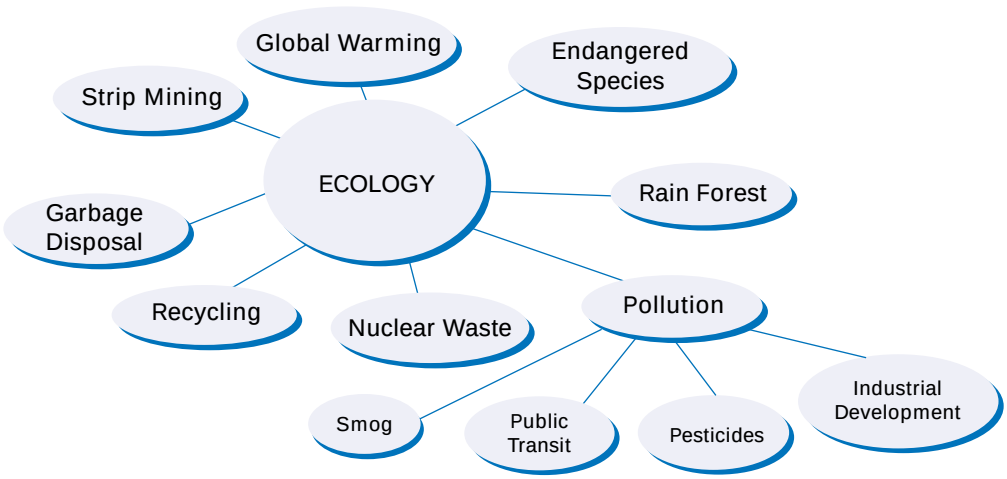
To learn more about creating mind maps, visit the above web site and follow the links. Write a brief description of how to create mind maps.

Example 2 Extended Mind Map

Extend the ECOLOGY mind map along the Pollution branch, with the sub-topics Smog, Pesticides, Public Transit, Industrial Development, and three other related sub-topics that your group has brainstormed.

Solution

The extended mind map is shown below. Add three ovals for the sub-topics that your group has brainstormed.



Posing a Problem

Once you have narrowed down your topic, you will need to pose a problem that you plan to investigate. Use the following checklists to evaluate potential problems.

The problem should satisfy *all* of the following:

- Be a significant problem of interest to you
- Involve the collection of a large amount of data
- Involve the organization of a large amount of data
- Involve the analysis of a large amount of data
- Allow the use of technology
- Allow the use of diagrams

The problem should use *some* of the following:

- One-variable statistics tools
- Two-variable statistics tools
- Matrices as tools
- Permutations and combinations
- Probability
- Probability distributions
- Simulations
- Hypothesis testing

Generating Questions

One way of posing a problem is to generate questions from data. For example, once a topic has been identified, do a preliminary data search. The type and quantity of available data may indicate some possible questions. Data from print sources, the Internet, and E-STAT are some resources that may be used.

WEB CONNECTION

www.mcgrawhill.ca/links/MDM12

For some links to interesting data sets visit the above web site. You might be able to find a data set that would help you decide on a topic for your culminating project

Practise

Work in small groups to complete questions 1 to 5.

1. Construct a mind map for each of the following topics. Brainstorm additional sub-topics to add to your group's mind map.

a) FINANCE

Sub-topics: tuition fees, student loans, interest rates, inflation, home ownership, stock market, mutual funds, and so on.

b) MARKETING

Sub-topics: market research, consumer behaviour, advertising, commercials, television, magazines, new products, taste tests, and so on.

c) WEATHER

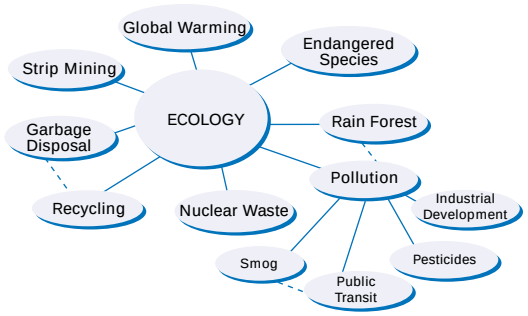
Sub-topics: hurricanes, thunderstorms, tornadoes, temperature, seasons, prediction, and so on.

d) GEOGRAPHY

Sub-topics: demographics, crops, climate, currency, and so on.

2. Select four of the topics below. Then, brainstorm sub-topics and construct a mind map for each of your four topics. Try to include several levels for your mind maps.
AUTOMOBILES
MUSIC
MOVIES
SPORTS
DANCE
FASHION
TRAVEL
OCCUPATIONS
RISK

3. Often topics in the same sub-level of a mind map are related. These related topics can be joined with dashed lines to show their relationship. This type of mind map is known as a **mind web**. The following diagram shows a partial mind web for ECOLOGY, with dashed lines to show connected topics.



a) In your notebook, complete the ECOLOGY mind web.

b) Construct mind webs for the topics your group selected in question 2.

4. In your group, select a major topic for a mind web.

5. Refer to the data you collected for your Tools for Data Management project. Generate at least three questions from these data. The questions should be different from the ones you answered in the project.

6. The following table lists data related to vehicle collisions in Ontario in one year. In your group, brainstorm at least five questions that could be investigated using these data. Remember that to actually answer your questions, additional research would be necessary. Do not do any additional research at this time.

Vehicle Collisions in Ontario

Age	Licensed Drivers	Number in Collisions	% of Drivers in Age Group in Collision
16	85 050	1 725	2.0
17	105 076	7 641	7.3
18	114 056	9 359	8.2
19	122 461	9 524	7.8
20	123 677	9 320	7.5
21–24	519 131	36 024	6.9
25–34	1 576 673	90 101	5.7
35–44	1 895 323	90 813	4.8
45–54	1 475 588	60 576	4.1
55–64	907 235	31 660	3.5
65–74	639 463	17 598	2.8
75 & older	354 581	9 732	2.7
Total	**7 918 314**	**374 073**	**4.7** (average)

7. Refer to the earthquake data on page 411. Use these data as a starting point to generate at least three questions to investigate. These questions may involve the earthquake data or a related topic.

8. Conduct a preliminary data search on the topic TOP GROSSING MOVIES. Generate at least three questions that could be investigated using your data.

9. Conduct a preliminary data search for a topic from the possible sources identified at the beginning of this section. Generate at least three questions from your data.

Moving Your Project Forward

Pose the question you will investigate in your culminating project.