

Understanding Canadian Demography with Mathematics

Math Camp 2025

Learning Objectives:

- Access data on Canadian population **demography**.
- Use charts to describe population demography today and compare it to the past including the population **census**, **fecundity**, and **mortality**.
- Calculate and interpret population **proportions** and **probabilities**.
- Calculate the **mean** and **mode** of the population **age distribution**.
- Express the age distribution as a **vector** and calculate life expectancy using the **dot product of two vectors**.
- Express demographic dynamics as a **flow diagram** and as a **Leslie matrix**.
- Project the future age distribution of the Canadian population using **matrix-vector multiplication**.

Pre-event questions:

*These pre-event questions are voluntary and are to facilitate student engagement only.
No student information will be recorded or shared.*

- Were your parents alive in 1971? How about your grandparents? If so, how old were they?
- How old were your parents in 1991?
- How old were your parents when you were born?
- How old is the oldest person you know?

The Canadian Census:

1. What is the most common age group in 2023? Who lives longer, women or men?
2. How long do you spend in each age group? What **proportion** of people age-up each year?
3. What is the biggest age group in 1971? Is the Canadian population getting older or younger?
4. Use this table to estimate the population size of Canada.

Fecundity:

5. How many female babies are born each year?
6. What is the most common age for a mom to give birth?
7. How many female babies were born each year in 1991?
8. Is the number of babies being born each year increasing or decreasing? Give the answer in the percentage increase/decrease.
9. Are moms getting older or younger over time?

Mortality:

1. What is the most common age for women to die at in Canada?
2. Why are there fewer deaths of 100-year-olds than there are of 80-year-olds?
3. What **proportion** of women over the age of 100 die each year?
4. If you just turned 100 what is the **probability** that you live to age 101?
5. If you just turned 100 what is the probability that you live to age 102? How about 103?

6. What is the life expectancy of Women in Canada?

Life expectancy=**average** age of death

We can also represent the current **age-distribution** of the population with a **vector**:

We can also create a vector giving the average ages of each age group:

We can find the life expectancy by taking the **dot product** of the two vectors.

Putting it all together:

The **Leslie matrix** describes:

Draw a **flow diagram** illustrating the demographic dynamics of the Canadian population:

A. We put births _____ of the Leslie matrix.

B. We incorporate aging by 1) _____

and 2) _____

C. We subtract deaths _____ of the Leslie matrix.

To find the age-distribution in the next year we **multiply** the Leslie **matrix by** the current population **vector**

