UNIVERSITY OF TORONTO | Engineering

Long term asset procurement strategies

Background

- Some projects are very large and span a long timeline
  - Infrastructure, military
- While projects are underway, the world continues to move forward
  - The plans we make may become obsolete during the project
- Factors affected by project duration
  - Scope
  - Exposure to risk
- Continuation of project started by previous student

Two directions

Probability distributions

- What are the likely values of projects of different durations?

- Select parameters for exploration
- Simulate uncertainty factors
- Generate distribution

Duration indifference

- What values do the projects need to have to be the same as each other?

- Compute expected values of different project lengths
- Find the relative value of indifference

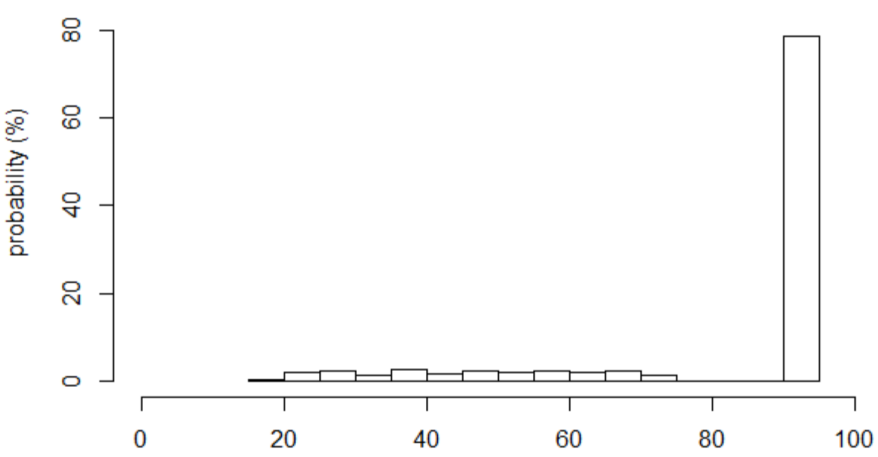
UNIVERSITY OF TORONTO | Engineering

Part I: Probability distributions

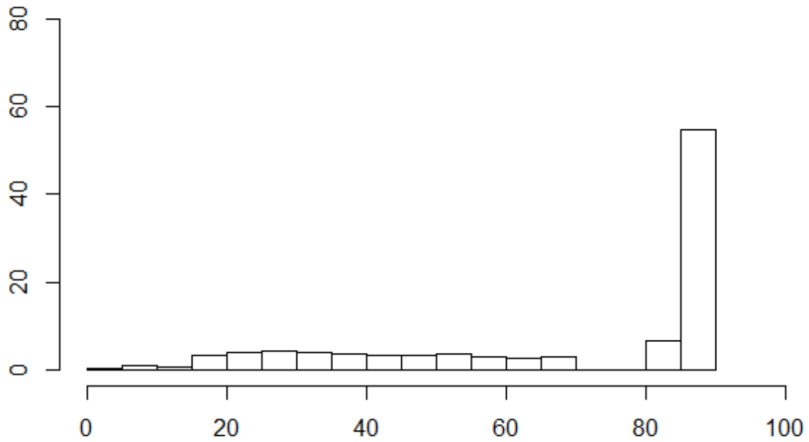
Problem setup

- Uncertainty parameters:
  - Annual depreciation U[0.01, 0.02]
  - Annual probability of catastrophic event 0.05
  - Percentage of project value lost in the event of a catastrophic event U[0.2, 0.8]
- Project durations of interest:
  - 5, 10, 20
- Only permit 1 instance of step loss per project
- 1000 replications each

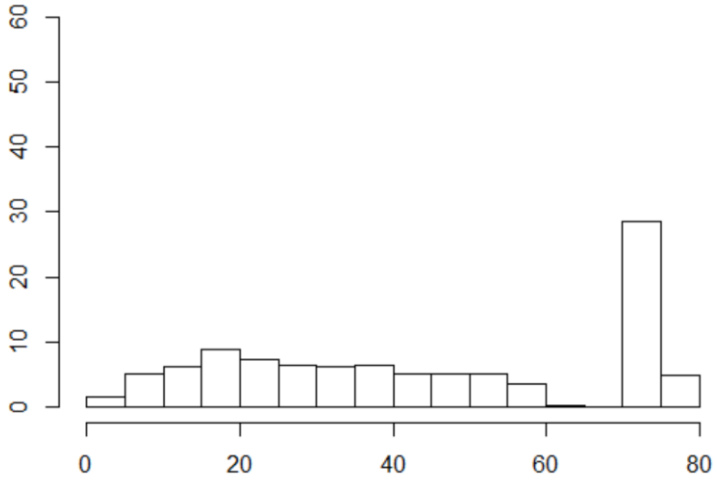
Results



5 year project



10 year project



20 year project

UNIVERSITY OF TORONTO | Engineering

Part II: Duration indifference

How do we equate two projects of different length?

- *“How much does a short project have to be worth in order to be equivalent to a longer project?”*
- Considering 5, 10 and 20-year projects
  - Relative values of projects to make them the same net present value
- Parameters
  - Annual depreciation 1%
  - Annual probability of step event 5%
  - Value lost at step event 50%

Expected value of any project

- Using total probability law:

$$E(\text{project}) = E(\text{project} \mid \text{catastrophe})\, P(\text{catastrophe}) + E(\text{project} \mid \text{no catastrophe})\, P(\text{no catastrophe})$$

- The project value considers annual depreciation over n years (n = 5, 10, 20), annual exposure to catastrophe, and a 50% loss if there's a catastrophe

E(project)

Project duration	E(Project)
5	84.3424
10	72.2935
20	55.5558

- After considering the potential losses over the project duration, these are the expected value of each project (starts at 100%)

Duration comparison

Project duration	E(Project)
5	84.3424
10	72.2935
20	55.5558

Repeat for all years between 5-20

See table in report

- To compare the proportional value of a 5-year project to a 10-year project
  - Let x be the proportional value of a 5-year project to a 10-year project

$$84.3424x \geq 72.2935$$

  - $x \geq 0.8571$
- A 5-year project whose value is 86% of 10-year project is equivalent
- Similarly, 10 to 20 is 77%