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
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
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
### Project Duration vs. Expected Value

<table>
<thead>
<tr>
<th>Project duration</th>
<th>E(Projet)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>84.3424</td>
</tr>
<tr>
<td>10</td>
<td>72.2935</td>
</tr>
<tr>
<td>20</td>
<td>55.5558</td>
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- After considering the potential losses over the project duration, these are the expected value of each project (starts at 100%).
Duration comparison

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• 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
  $\frac{84.3424}{10} \geq \frac{72.2935}{10}$
  – $x \geq 0.8571$

• A 5-year project whose value is 86% of a 10-year project is equivalent

• Similarly, 10 to 20 is 77%

Repeat for all years between 5-20
See table in report