REVIEW of Individual Assignment 2: Risk Assessment & Benefit Cost Analysis

Frameworks and Models in Engineering Systems (FAMES)

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Assignment IA2: Risk Assessment

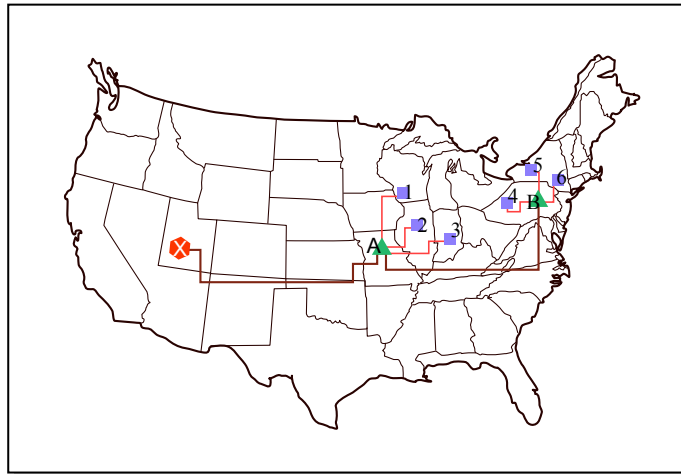- Application of Risk Assessment on a simplified case of transportation of SNF

Figure by MIT OpenCourseWare.

Table 1: Network distances and Population Centers

OD pair	Highway Distance (in miles)	Number of Cities	Population	Rail adjustment
1A	300	1	300.000	x1.1
2A	150	3	100.000 each	x1.2
3A	350	1	50.000	x0.9
4B	150	3	75.000 each	x1
5B	200	1	50.000	x1.3
6B	300	1	1.000.000	x0.8
BA	1000	4	100.000 each	x1.1
AX	1500	5	50.000 each	x1.1

Note that for rail access multiply the distances by the given factor.

IA2: Risk Assessment

- Points to notice:
  - Creating alternatives (straight forward)
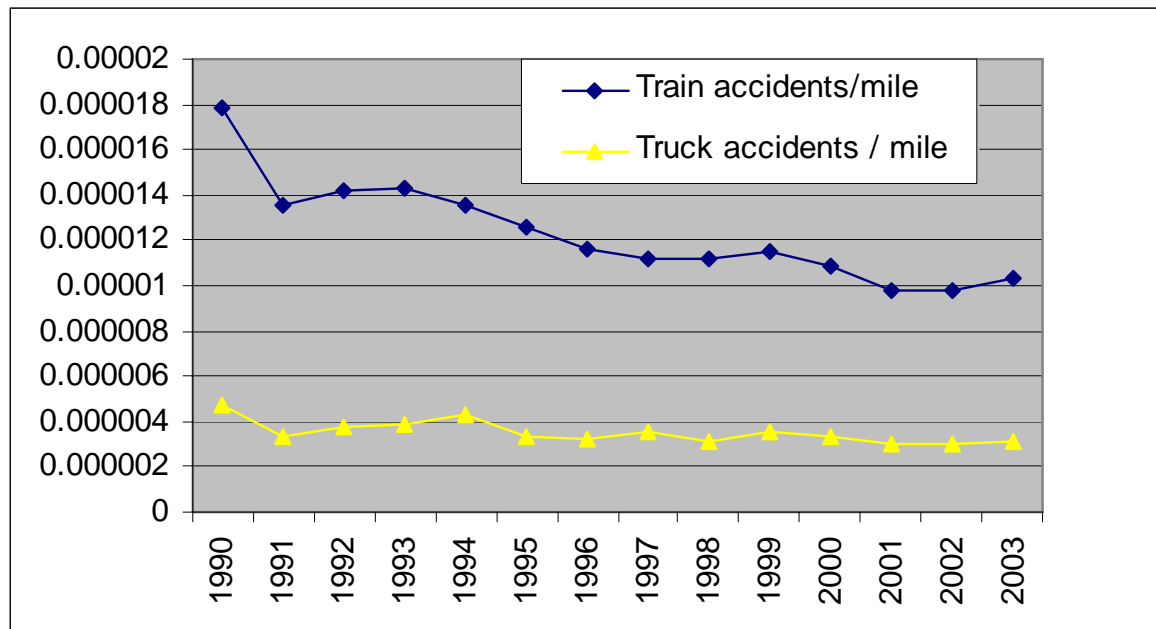 - Calculating **Expected Value** of accidents from the given probabilities

  EV (X) = P(X) * V (X)

  - Probabilities
  - Error in 4 (given an accident happens)
  - This section does NOT consider transportation costs.

Mary's question (+ a hint for P3?)

- www.bts.gov (useful site to keep in mind)

- The assignment's data are made up. Nevertheless use them for this solution.

IA2: Risk Assessment

- **Brief Probability Review**
  - What is the probability of an unbiased die returning 2 for three consecutive throws?
  - $(1/6)^3$
  - What is the probability of an unbiased die returning 2 **at least once** in three consecutive throws?
  - P(not 2) = $(1-1/6)^3$
  - P(at least one 2) = 1 - P(not 2)

Questions on IA2 Risk Assessment ?

Review of Benefit Cost Analysis 1

- ## What is BCA?
  - A way to compare alternatives
- ## Objective: normalizing benefits and costs in a way that are comparable internally and across projects.
- ## Key concept: value of money changes over time.
- ## Discount rate vs. interest rate and Opportunity costs.

Review of Benefit Cost Analysis 2

- Different ways to compare:
  – Net Present Value (NPV) → recommended for IA2
  – Benefit Cost Ratio
  – Internal rate of return (IRR)
  – Payback Period
  – Cost-effectiveness ratio
  – ...

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Review of Benefit Cost Analysis 3

- Calculate NPV for the different alternatives. The one with the higher NPV is chosen (absent politics).

- How to calculate NPV for discount rate r:

  – The value of a future sum (F) at N years:

  $P = F(1+ r)^N$

  – The value of a RECURRING future sum (F) at N years:

  $P = F[(1- 1/(1+r)^N)/r]$

Review of Benefit Cost Analysis 3

- Some issues to notice:
  - Net Present Value (NPV) → does not account for scale
  - Does NPV equals profit?
  - Benefit Cost Ratio → favors capital intensive projects vs. those with high recurring costs

Questions on IA2 BCA ?

Issues with BCA

- Monetization and implicit monetization
- Difficulty to compute bc due to uncertainty
- Evaluative complexity on costs and benefits
- Discounting non discountable events
- Distributive equity
- Aggregation (non transparency) and a devilish devil

DR Discussion

- Choice of Discount rate depends on:
  – Opportunity cost of capital
- DR determines technology and choice preference.
  – Should state use different DR than business?