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Economics for Public Decisions

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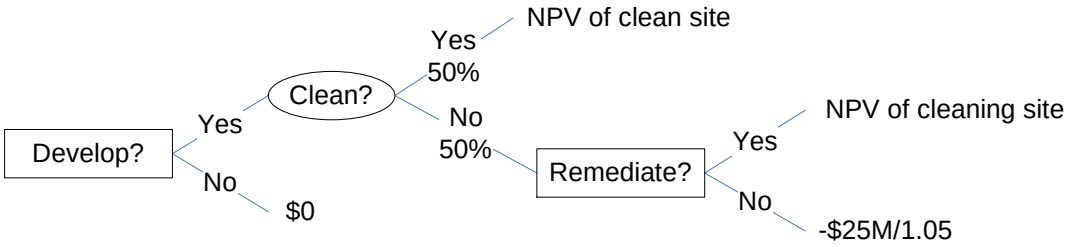
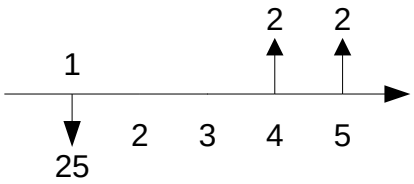
Solution to Exercise 10

Part A, Expected Net Present Value

The basic decision tree is shown below. The payoffs are NPVs in period 0 and will be calculated shortly. The initial decision is whether or not to develop the site. If development proceeds, the site's true condition will be discovered at the "Clean?" node. If the site is contaminated, the city faces a second decision: whether to abandon the project or clean up the pollution. If it abandons the site, it loses the PV of the $25 million construction cost ($25M/1.05).



The cash flow of a clean site:

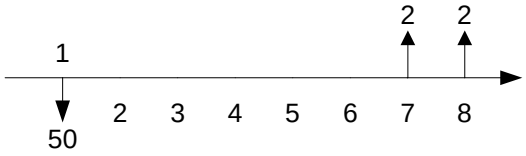


Calculating the PV:

PV = -$25M/1.05 + ($2/0.05)/(1.05^3)

PV = $10.74M

The cash flow of cleaning and developing the site:

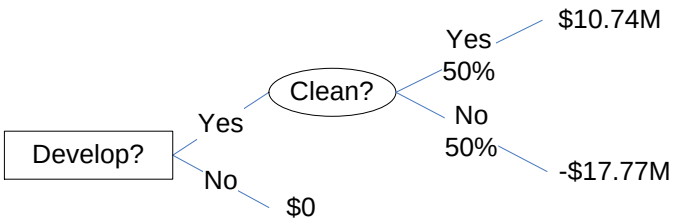


Calculating the PV:

PV = -$50M/1.05 + ($2/0.05)/(1.05^6)

PV = -$17.77M

Given this information, the tree can be simplified. Although the NPV of cleaning up a dirty site at the "Remediate?" decision is negative, it is less negative than abandoning the project. Thus, the city would choose to remediate if the site turned out to be dirty. Simplifying the tree by inserting the relevant payoffs:



The expected value of developing the site can now be computed:

EV = 0.5*($10.74M) +0.5*(-$17.77M)

EV = -$3.51M

Since the EV of developing is negative (and thus worse than the $0 alternative payoff) it would be better NOT to develop the site.

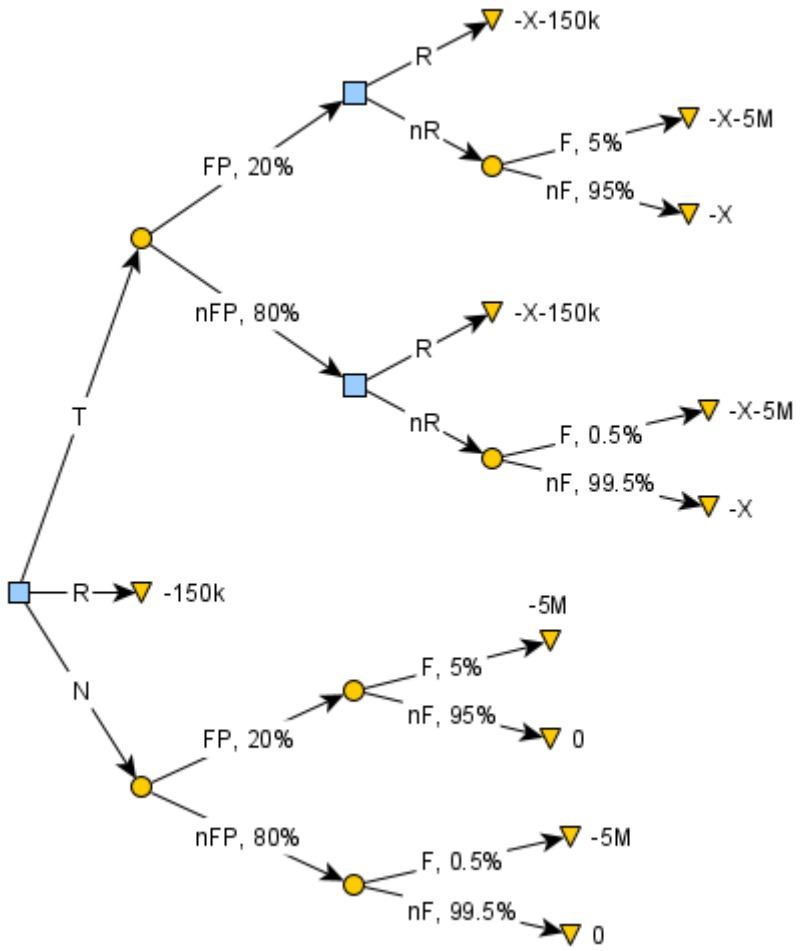
Part B, Value of Information

The initial decision tree is shown in Figure B.1 below. The cost of the test is shown as X. The actions and random states are abbreviated as follows:

Table B.1: Abbreviations

Actions	T	Hire the engineering firm to test the floodplain
	R	Renovate the building
	N	Do nothing: BAU
	nR	Don't renovate the building
States	FP	The floodplain has changed
	nFP	The floodplain has not changed
	F	A flood occurs
	nF	No flood occurs

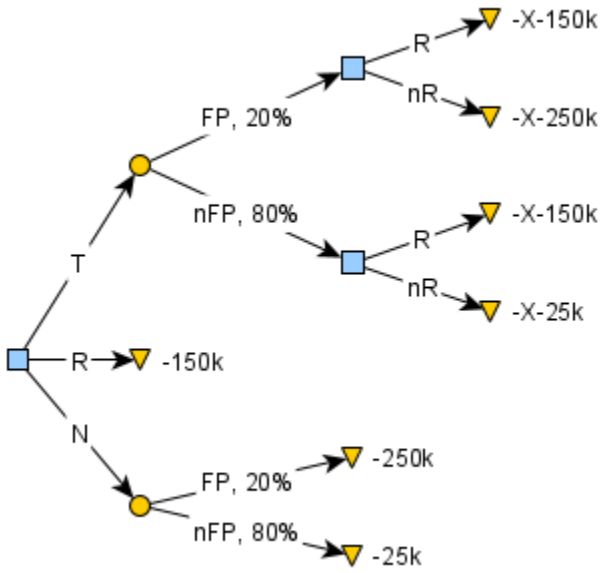
Figure B.1: Initial Decision Tree



Note that the R action leads straight to a payoff even though a flood could still occur. That's because the flood no longer causes any damage and doesn't affect the city's payoff.

Evaluating the right-most nodes in the tree allows it to be simplified as shown in Figure B.2 below:

Figure B.2: Tree After Simplification 1



Evaluating and simplifying twice more produces the trees shown in B.3 and B.4:

Figure B.3: Tree After Simplification 2

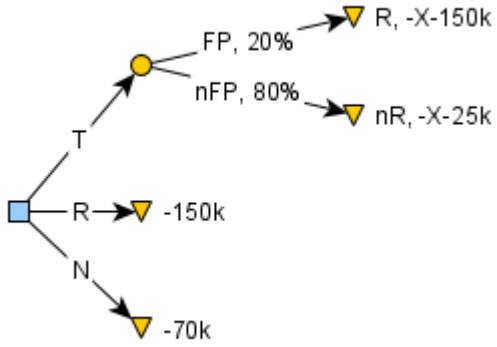
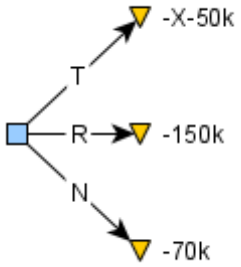


Figure B.4: Tree After Simplification 3



The maximum value of X makes the payoff from T just equal to the next best option, which is N:

$$-X - 50k = -70k$$

$$X = 70k - 50k$$

$$X = 20k$$

Thus, the maximum the city should pay for the test is $20k.