

Chapter 16

16.1 Election Campaign

a) Go to city B for an expected number of votes equal to 1020. See Figure S16.1

b) The votes have value only if they are sufficient to win. Taking winning to have a value of plus 1 and losing equal to zero, going to a maximized expected value. Chances of winning are maximal in city A (50% vs. only 30% in city B).

16.2 Money Bags, Take 2

a) See Figure S16.2

Prior probabilities: $P(1000) = P(320) = 0.5$
 $P(20/320) = .25$ $P(20/1000) = 0$
 $P(100/320) = .75$ $P(100/1000) = 1.0$

$P(20) = P(20/320) P(320) + P(20/1000) P(1000) = 0.125$
 $P(100) = 1 - P(20) = 1 - .125 = .875$

$P(1000/100) = [P(100/1000) P(1000)] / P(100) = 1.0 (0.5) / .875 = .57$
 $P(320/100) = [P(100/320) P(320)] / P(100) = 0.75 (0.5) / 0.875 = 0.43$

b) Take the wallet.

16.3 Assembly Robot

a) See Figure S16.3

b) Notation: A = Aligned; \bar{A} = Not aligned
OK = Test results okay \overline{OK} = Test results not okay

Given: $P(OK/A) = .8 \rightarrow P(\overline{OK}/A) = .2$
 $P(\overline{OK}/\bar{A}) = .9 \rightarrow P(OK/\bar{A}) = .1$
 $P_o(A) = .7 \rightarrow P_o(\bar{A}) = .3 \rightarrow P(OK) = .7(.8) + .3(.1) = .59$
 $P(\overline{OK}) = .41$

Revised probabilities after test:

$P(A/OK) = P_o(A) [P(OK/A) / P(OK)] = .95 \rightarrow P(\bar{A}/OK) = 0.5$
 $P(A/\overline{OK}) = P_o(A) [P(\overline{OK}/A) / P(\overline{OK})] = .34 \rightarrow P(\bar{A}/\overline{OK}) = .66$

c) From these revised probabilities, least expected time actions can be selected (pound if test okay; nudge if not) to arrive at an expected time of 0.36 seconds after the test. the total expected time for the branch starting with a test is 0.41 sec., which is less than the expectation for either pound (.044 sec.) or nudge (0.46 sec).

16.4 Mars Probe

- a) Notation: S_X = Success of experimental method X
 \bar{S}_X = Failure of experimental method X
 S_Y = Success of experimental method Y
Sim = Simulation of method X experiment succeeds
 \bar{S}_{im} = Simulation of method X experiment fails

Since the initial probabilities that theories A or B is true are 50/50:

$$P(S_X) = P(S_X/A)P_o(A) + P(S_X/B)P_o(B) = .8(.5) + .4(.5) = 0.6$$
$$P(S_Y) = P(S_Y/A)P_o(A) + P(S_Y/B)P_o(B) = .4(.5) + .7(.5) = 0.55$$

- b) See Figure S16.4.
 $EV(\text{method X}) = EV_X = .6(\$10M) + .4(\$0M) = \$6M$
 $EV_Y = .55(\$10M) + .45(\$0M) = \$5.5M$
- c) Since $EV_X > EV_Y$, Method X should be used

16.5 Software Development

- a) See Figure S16.5
- b) Buy license for A, which has expected value $\$4.5M > \$3.75M$ for B.

16.6 Traffic Department

- (a), (b), (c) See Figure S16.6.

- d) Notation:
A means theory A is true
0 or 1 means payoff in first period is 0 or 1.

$$P(A) = P(B) = 1/2$$
$$P(1/A) = .8 \quad P(0/A) = .2$$
$$P(1/B) = .1 \quad P(0/B) = .9$$

Then: $P(1) = P(1/A)P(A) + P(1/B)P(B) = .45$
 $P(0) = 1 - P(1) = .55$

Now revise original 50 : 50 probabilities of theory A and B given that doing X yields 0 or 1:

$$P(A/1) = P(A) [P(1/A)/P(1)] = 8/9$$
$$P(B/1) = 1/9$$
$$P(A/0) = 2/11 \quad P(B/0) = 9/11$$

Hence, the new probability of getting 1 are, if we got 0 the first time:

$$P(1) = P(1/A)P(A/0) + P(1/B)P(B/0) = .8(2/11) + .1(9/11) = 5/22$$

$$P(0) = 17/22$$

If we got 1 on first time: $P(1) = 13/18$ $P(0) = 5/18$

The expected values can then be computed, as in Figure S16.6.

e) The best strategy is to choose X in the first period, and then choose Y or X in the second, depending on whether the result in the first period is 0 or 1.

16.7 Oil Exploration

See Figure S16.7

$$EV(A) = .05(0) + .4(20k) + .5(100k) + .05(1000k) = 108$$

$$EV(B) = .1(0) + .75(20k) + .1(100k) + .05(1000k) = 75$$

$$EV(C) = .7(0) + .05(20k) + .05(100k) + .2(1000k) = 206$$

Choose site C.

16.8 Earthquake Protection

a) See Figure S16.8

b) Choose option (2). Design the house to survive a moderate earthquake.

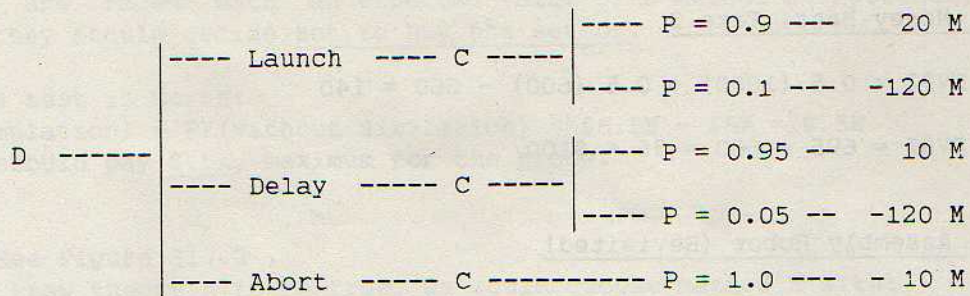
16.9 Sonny's PV's

a) See Figure S16.9.

b) Pick new method, $EV = 8.3$.

16.10 PY-RIC Enterprises

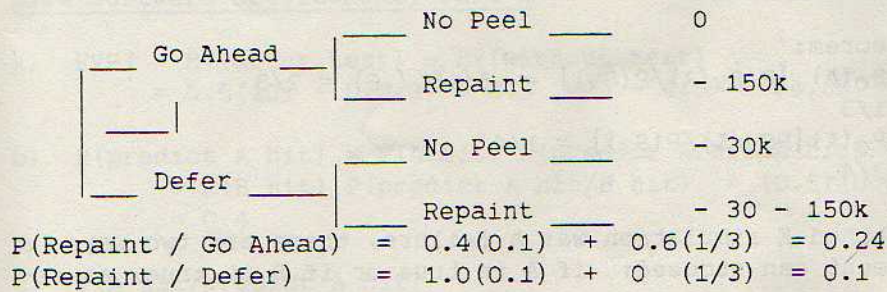
a)



b) EV (Launch) = 0.9 (20) + 0.1 (-120) = 18 - 12 = 6
 EV (Delay) = 0.95 (10) + 0.05 (-120) = 3.5
 EV (Abort) = - 10

Therefore launch.

16.11 Marian Haste



EV(Go Ahead) = 0.24 (-150) = - 36k best choice
 EV(Defer) = 0.10 (-150) - 30 = - 45k

16.12 P. O'Toole

See Figure S16.10

Level of Production :	Low	Med	High
Cost of Production :	14,000	28,000	42,000

$EV(\text{High}) = 0.1(72) + 0.4(66) + 0.3(58.5) + 0.2(51) - 42$
 $= 7.2 + 26.4 + 17.55 + 10.4 - 42 = 19.15$
 $EV(\text{Med}) = 0.5(54) + 0.3(49.5) + 0.2(42) - 28$
 $= 27 + 14.85 + 8.4 - 28 = 22.25 \quad \text{Best}$
 $EV(\text{Low}) = 0.8(36) + 0.2(33) - 14 = 21.4$