CS 480 Homework 8 & 9

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1

1. Evidence = NULL
2. Select INVEST
   - $EU = .1 * 1000 + .9 * -200 = -80$
3. Select NOT INVEST
   - $EU = .1 * -500 + .9 * 100 = 40$
4. MEU = 40, Select NOT INVEST

2

- $VOI(PLC) = P(PLC = S) * MEU|PLC = S + P(PLC = F) * MEU|PLC = F - MEU =?$
- $P(PLC = S) = .1 * .6 + .9 * .3 = .33$
- $P(PLC = F) = .1 * .4 + .9 * .7 = .67$
- $MEU|PLC = S =?$
  1. Evidence: PLC = S
  2. Select INVEST
     - $P(St = S|PLC = S) = P(PLC = S|St = S) * P(St = S)/P(PLC = S) = .6 * .1/.33 = .1818$
     - $P(St = F|PLC = S) = P(PLC = S|St = F) * P(St = F)/P(PLC = S) = .3 * .9/.33 = .8181$

- $EU = .1818 * 1000 + .8181 * -200 = 18.18$

3. Select NOT INVEST
   - $EU = .1818 * -500 + .8181 * 100 = -9.09$

- $MEU|PLC = S = 18.18$
- $MEU|PLC = F =$?

1. Evidence: PLC = F
2. Select INVEST
   - $P(St = S|PLC = F) = P(PLC = F|St = S) * P(St = S)/P(PLC = F) = .4 * .1/.67 = .05$
   - $P(St = F|PLC = F) = P(PLC = F|St = F) * P(St = F)/P(PLC = F) = .7 * .9/.67 = .94$
   - $EU = .05 * 1000 + .94 * -200 = -138$
3. Select NOT INVEST
   - $EU = .05 * -500 + .94 * 100 = 69$

- $MEU|PLC = F = 69$
- $VOI(PLC) = P(PLC = S) * MEU|PLC = S + P(PLC = F) * MEU|PLC = F - MEU = .33 * 18.18 + .67 * 69 - 40 = 12.23$

3

- $VOI(PPC) = P(PPC = S) * MEU|PPC = S + P(PPC = F) * MEU|PPC = F - MEU =$?
- $P(PPC = S) = .1 * .8 + .9 * .3 = .35$
- $P(PPC = F) = .1 * .2 + .9 * .7 = .65$
- $MEU|PPC = S =$?

1. Evidence: PPC = S
2. Select INVEST
   - $P(St = S|PPC = S) = P(PPC = S|St = S) * P(St = S)/P(PPC = S) = .8 * .1/.35 = .23$
   - $P(St = F|PPC = S) = P(PPC = S|St = F) * P(St = F)/P(PPC = S) = .3 * .9/.35 = .77$
   - $EU = .23 * 1000 + .77 * -200 = 76$

3. Select NOT INVEST
   - $EU = .23 * -500 + .77 * 100 = -38$

- $MEU|PPC = S = 76$
- $MEU|PPC = F =?$
  1. Evidence: PPC = F
  2. Select INVEST
     - $P(St = S|PPC = F) = P(PPC = F|St = S) * P(St = S)/P(PPC = F) = .2 * .1/.65 = .03$
     - $P(St = F|PPC = F) = P(PPC = F|St = F) * P(St = F)/P(PPC = F) = .7 * .9/.65 = .97$
     - $EU = .03 * 1000 + .97 * -200 = -164$
  3. Select NOT INVEST
     - $EU = .03 * -500 + .97 * 100 = 82$
- $MEU|PPC = F = 82$
- $VOI(PPC) = P(PPC = S) * MEU|PPC = S + P(PPC = F) * MEU|PPC = F - MEU = .35 * 76 + .65 * 82 - 40 = 39.9$

4

- $VOI(PPC|PLC = S) = P(PPC = S|PLC = S) * MEU|PPC = S, PLC = S + P(PPC = F|PLC = S) * MEU|PPC = F, PLC = S - MEU|PLC = S =?$
- $P(PPC = S|PLC = S) = P(St = S)P(PPC = S|St = S)P(PLC = S|St = S) + P(St = F)P(PPC = S|St = F)P(PLC = S|St = F) = Norm(.1*.6*.8+.9*.3*.3) = .39$
- $P(PPC = F|PLC = S) = P(St = S)P(PPC = F|St = S)P(PLC = S|St = S) + P(St = F)P(PPC = F|St = F)P(PLC = S|St = F) = Norm(.1*.2*.6+.9*.7*.3) = .61$
- $MEU|PPC = S, PLC = S =?$
  1. Evidence: PPC = S,PLC= S
  2. Select INVEST
     - $P(St = S|PLC = S, PPC = S) = P(St = S)P(PLC = S|St = S)P(PPC = S|St = S) = Norm(.1 * .6 * .8) = .372$

- $P(St = F|PLC = S, PPC = S) = P(St = F)P(PLC = S|St = F)P(PPC = S|St = F) = Norm(.9 * .3 * .3) = .628$
- $EU = .375 * 1000 + .628 * -200 = 249.4$

3. Select NOT INVEST
   - $EU = .375 * -500 + .628 * 100 = -124.7$

- $MEU|PPC = S, PLC = S = 249.4$
- $MEU|PPC = F, PLC = S =?$

1. Evidence: PPC = F, PLC = S
2. Select INVEST
   - $P(St = S|PLC = S, PPC = F) = P(St = S)P(PLC = S|St = S)P(PPC = F|St = S) = Norm(.1 * .6 * .2) = .06$
   - $P(St = F|PLC = S, PPC = F) = P(St = F)P(PLC = S|St = F)P(PPC = F|St = F) = Norm(.9 * .3 * .7) = .94$
   - $EU = .0597 * 1000 + .9403 * -200 = -128.358$
3. Select NOT INVEST
   - $EU = .0597 * -500 + .9403 * 100 = 64.179$

- $MEU|PPC = F, PLC = S = 64.179$
- $VOI(PPC|PLC = S) = P(PPC = S|PLC = S) * MEU|PPC = S, PLC = S + P(PPC = F|PLC = S) * MEU|PPC = F, PLC = S - MEU|PLC = S = .39 * 249.4 + .61 * 64.179 - 18.18 = 118.235$

5

- $VOI(PPC|PLC = F) = P(PPC = S|PLC = S) * MEU|PPC = S, PLC = S + P(PPC = F|PLC = S) * MEU|PPC = F, PLC = S - MEU|PLC = S =?$
- $P(PPC = S|PLC = F) = P(St = S)P(PPC = S|St = S)P(PLC = F|St = S) + P(St = F)P(PPC = S|St = F)P(PLC = S|St = F) = Norm(.1*.8*.4+.9*.3*.7) = .33$
- $P(PPC = F|PLC = F) = P(St = S)P(PPC = F|St = S)P(PLC = F|St = S) + P(St = F)P(PPC = F|St = F)P(PLC = S|St = F) = Norm(.1*.2*.4+.9*.7*.7) = .67$
- $MEU|PPC = S, PLC = F =?$

1. Evidence: PPC = S,PLC= S

2. Select INVEST
   - $P(St = S|PLC = F, PPC = S) = P(St = S)P(PLC = F|St = S)P(PPC = S|St = S) = Norm(.1 * .4 * .8) = .14$
   - $P(St = F|PLC = F, PPC = S) = P(St = F)P(PLC = F|St = F)P(PPC = S|St = F) = Norm(.9 * .7 * .3) = .86$
   - $EU = .14 * 1000 + .86 * -200 = -32$
3. Select NOT INVEST
   - $EU = .14 * -500 + .86 * 100 = 16$

- $MEU|PPC = S, PLC = F = 16$
- $MEU|PPC = F, PLC = F =?$
  1. Evidence: PPC = F, PLC = F
  2. Select INVEST
     - $P(St = S|PLC = F, PPC = F) = P(St = S)P(PLC = F|St = S)P(PPC = F|St = S) = Norm(.1 * .4 * .2) = .02$
     - $P(St = F|PLC = F, PPC = F) = P(St = F)P(PLC = F|St = F)P(PPC = F|St = F) = Norm(.9 * .7 * .7) = .98$
     - $EU = .02 * 1000 + .98 * -200 = -176$
  3. Select NOT INVEST
     - $EU = .02 * -500 + .98 * 100 = 88$
- $MEU|PPC = S, PLC = F = 88$
- $VOI(PPC|PLC = F) = P(PPC = S|PLC = F) * MEU|PPC = S, PLC = F + P(PPC = F|PLC = F) * MEU|PPC = F, PLC = F - MEU|PLC = F = .33 * 16 + .67 * 88 - 69 = -4.76$

6

1. $MEU = 40$
2. $MEU = 59$
3. $MEU = 37$ This strat does not overcome PC's cost, the above is better.
4. $MEU = 194.4$ This seems too high, to be honest, however it has the best MEU, so it is the rational choice.
5. $MEU = 71.192$ $P(PLC = F)(MEU|PLC = F - 10) + P(PLC = T)(P(PPC = F|PLC = T)(MEU|PPC = F, PLC = T - 55) + P(PPC = T|PLC = T)(MEU|PPC = T, PLC = T - 55))$

6. $MEU = 44.46\ P(PPC = F)(MEU|PPC = F - 45) + P(PPC = T)(P(PLC = F|PPC = T)(MEU|PPC = T, PLC = F - 55) + P(PLC = T|PPC = T)(MEU|PPC = T, PLC = T - 55))$