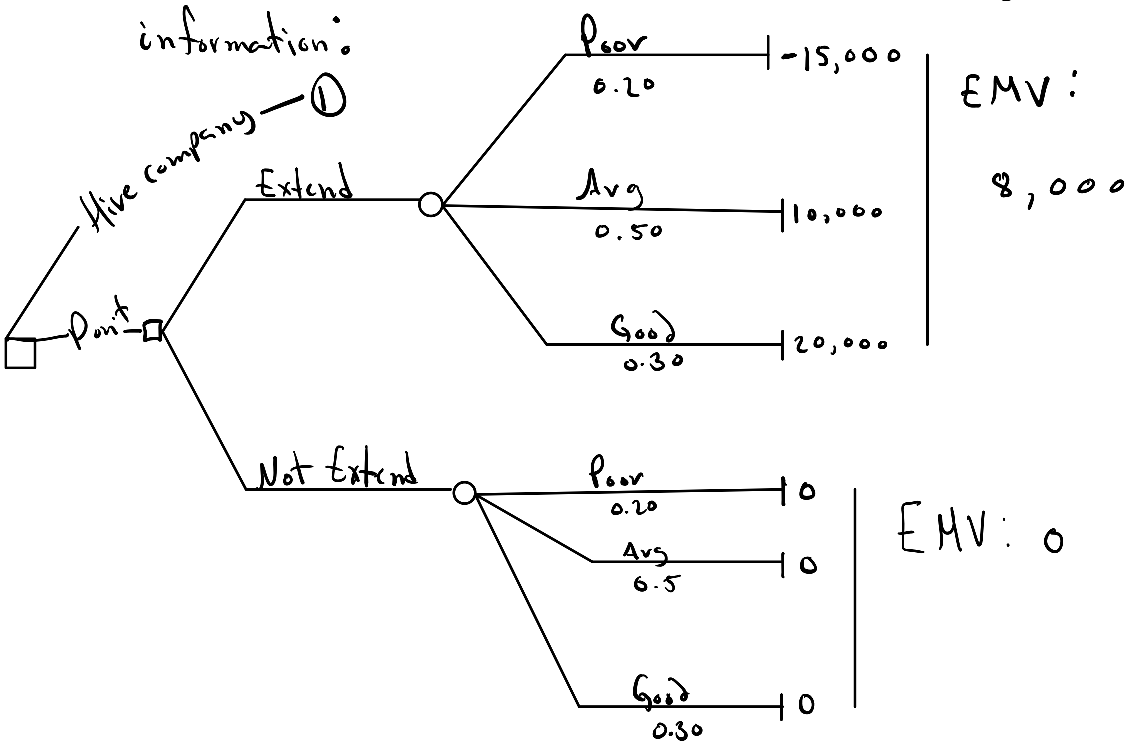
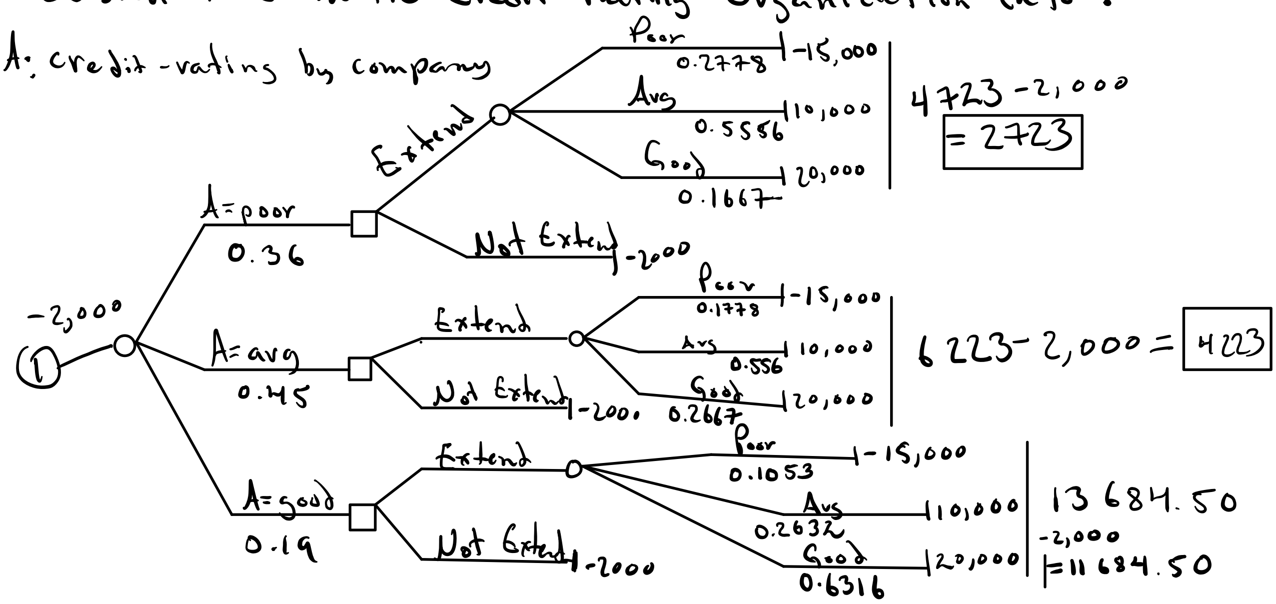
14.3 $P(\text{poor}) = 0.20$, $P(\text{avg}) = 0.50$, $P(g) = 0.30$

a) Decision tree without credit-rating organization information:



Decision tree with Credit-Rating Organization info:

A: credit-rating by company



Calculating probabilities: Let good = g , average = avg , poor = p

$P(A=p) = P(A=p \cap p) + P(A=p \cap avg) + P(A=p \cap good)$

$P(A=p = P(A=p \mid p) \cdot P(p) + P(A=p \mid avg) \cdot P(avg) + P(A=g \mid g) \cdot P(g)$

$P(A=p) = (0.50) \cdot (0.20) + (0.40)(0.50) + (0.20)(0.30) = 0.36$

For $P(A=avg)$:

$P(A=avg) = P(A=avg \mid p) \cdot P(p) + P(A=avg \mid avg) \cdot P(avg) + P(A=avg \mid g) \cdot P(g)$

$P(A=avg) = (0.40)(0.20) + (0.50)(0.50) + (0.40)(0.30) = 0.45$

$\therefore P(A=avg) = 0.45$

for $P(A=g)$:

$P(A=g \mid p) \cdot P(p) + P(A=g \mid avg) P(avg) + P(A=g \mid g) \cdot P(g)$

$= (0.10)(0.20) + (0.10)(0.50) + (0.40)(0.3) = 0.19$

- $P(poor \mid A=poor) = \dfrac{P(A=p \mid p) \cdot P(p)}{P(A=p)} = \dfrac{(0.5)(0.20)}{0.36} = 0.277\bar{8}$
- $P(avg \mid A=p) = \dfrac{P(A=p \mid avg) \cdot P(avg)}{P(A=p)} = \dfrac{(0.40)(0.50)}{0.36} = 0.555\bar{6}$
- $P(g \mid A=p) = \dfrac{P(A=p \mid g) \cdot P(g)}{P(A=p)} = \dfrac{(0.20)(0.30)}{0.36} = 0.166\bar{7}$

- $P(p \mid A=avg) = \dfrac{P(A=avg \mid p) \cdot P(p)}{P(A=avg)} = \dfrac{(0.40) \cdot (0.20)}{0.45} = 0.1778$
- $P(avg \mid A=avg) = \dfrac{P(A=avg \mid avg) \cdot P(avg)}{P(A=avg)} = \dfrac{(0.50) \cdot (0.5)}{0.45} = 0.5556$

- $P(g \mid A=avg) = \dfrac{P(A=avg \mid g) \cdot P(g)}{P(A=avg)} = \dfrac{(0.40)(0.30)}{0.45} = 0.2667$

- $P(p \mid A=g) = \dfrac{P(A=g \mid p) \cdot P(p)}{P(A=g)} = \dfrac{(0.10)(0.20)}{0.19} = 0.1053$
- $P(avg \mid A=g) = \dfrac{P(A=g \mid avg) \cdot P(avg)}{P(A=g)} = \dfrac{(0.10)(0.5)}{0.19} = 0.2632$
- $P(g \mid A=g) = \dfrac{P(A=g \mid g) \cdot P(g)}{P(A=g)} = \dfrac{(0.40)(0.30)}{0.19} = 0.6316$

(c) Optimal policy:

Pay the credit-rating company and extend credit to the dress manufacturer.

(d)

$EMV(\text{No info}) = 8000$

$EMVPI = (0.5) \cdot 10{,}000 + 0.30(20000)$

$= 11{,}000$

$11{,}000 - 8{,}000 = 3{,}000$

$\therefore$ The max we are willing to pay for perfect information is 3,000.