Exam 2
Notes on Solution

Table of discount factors

int 5%

year	1	5	10	15	20	25	30	35	40
(1+i)^t	1.0500	1.2763	1.6289	2.0789	2.6533	3.3864	4.3219	5.5160	7.0400

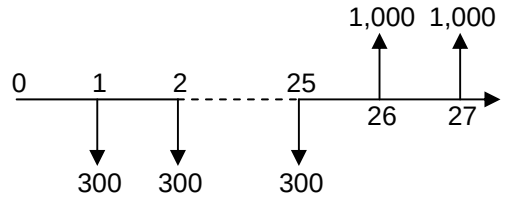
1 Rationality

Need to discuss transitivity and completeness. Explain that economists don't assume that everyone is always rational in this sense, and that the economic model of choice would not be applicable when completeness and transitivity don't hold. Would need to use psychology or sociology or other approaches to understand choice in those circumstances.

2 Disease eradication

annual cost	=	300
annual benefit	=	1,000
int rate	=	5%
years of costs	=	25

cash flows:

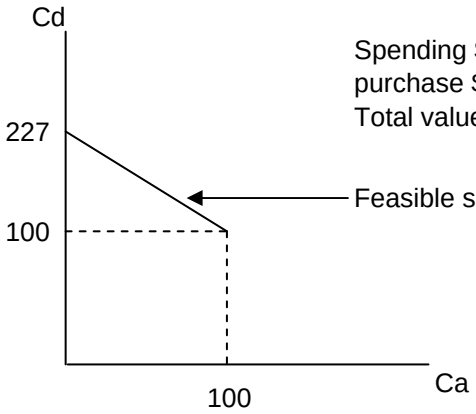


PV of costs forever	=	6,000						
PV of costs after 25	=	1,772	6,000	/	3.3864	=	1,772
PV of costs through 25	=	4,228	6,000	-	1,772	=	4,228
PV of benefits forever at 25	=	20,000	1,000	/	0.0500	=	20,000
PV of benefits at 0	=	5,906	20,000	/	3.3864	=	5,906
Net PV of the program	=	1,678	5,906	-	4,228	=	1,678

3 Democratic nomination

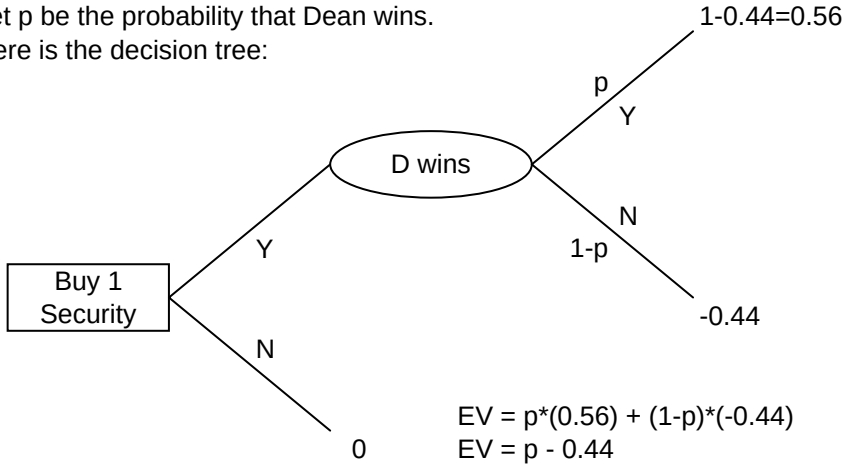
3a	Price of Dean security	=	0.44						
	Payoff in state D	=	1.00	(Dean wins)					
	Payoff in state A	=	0.00	(Anyone else wins)					
	Net payoff in state D	=	0.56	(From 1 Dean security:	1	-	0.44	=	0.56)
	Net payoff in state A	=	-0.44	(From 1 Dean security:	0	-	0.44	=	-0.44)

3b Graph



Spending $100 on D securities would
purchase $100/0.44 = 227.3 securities
Total value in D would be 227.3 (100 + 0.56*227.3)

3c Let p be the probability that Dean wins.
Here is the decision tree:



EV = p*(0.56) + (1-p)*(-0.44)
EV = p - 0.44

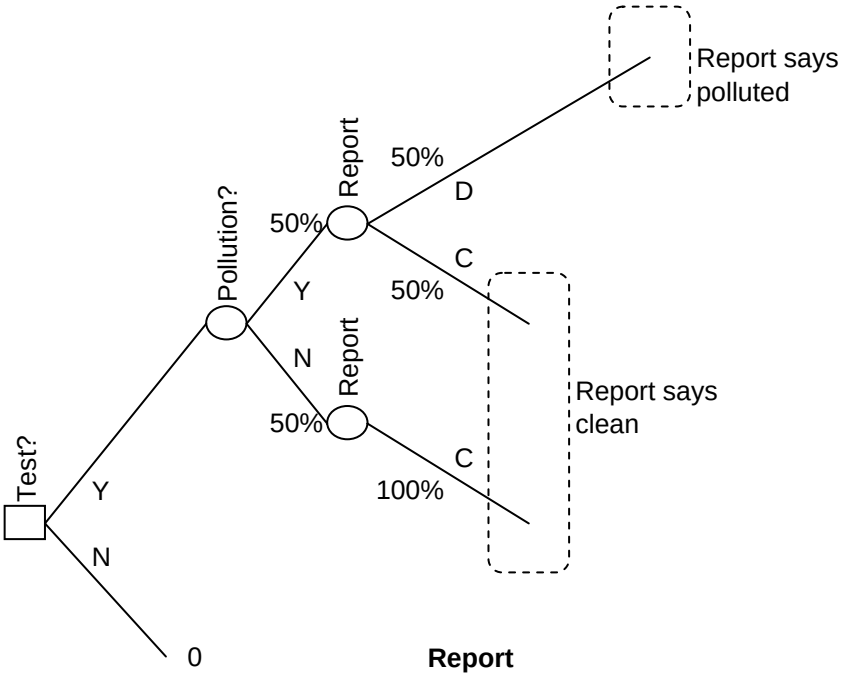
A risk-neutral market would lead to actuarially fair pricing with EV=0.
Therefore, the participants in the market must estimate that Dean's
probability of winning is p=44%

4 Testing a brownfield

prob contaminated = 50%
payoff if clean = 4
payoff if contaminated = -10

EV of developing = 0.5*(4)+0.5*(-10)
EV of developing = -3

test is available for 0.1
test finds contamination when present 50% of the time



Pollution?	Report Pollution?	Prob				
Yes	Yes	0.50	*	0.50	=	0.25
Yes	Clean	0.50	*	0.50	=	0.25
Clean	Yes	0.50	*	0.00	=	0.00
Clean	Clean	0.50	*	1.00	=	0.50

Conditional prob that clean given a clean report:

prob of receiving a clean report	=	0.25	+	0.50	=	0.75
prob clean and report says clean	=	0.50				
conditional prob clean given report	=	0.50	/	0.75	=	0.667
conditional prob DIRTY given report	=	0.25	/	0.75	=	0.333

EV of proceeding given the clean report:

EV = 0.667 * 4 + 0.333 * -10 - 0.1
EV = -0.77

EV of not proceeding given a clean report is -0.1
It would be better not to develop the property.

Conditional probability of clean given a dirty report

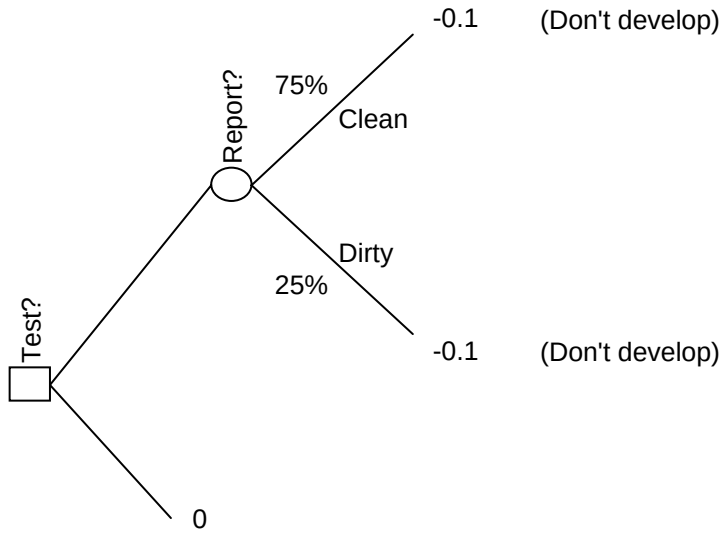
prob of receiving a dirty report	=	0.25	+	0.00	=	0.25
prob clean and report says dirty	=	0.00				
conditional prob clean given report	=	0.00	/	0.25	=	0.000
conditional prob DIRTY given report	=	0.25	/	0.25	=	1.000

EV of proceeding given the dirty report:

EV = 0.000 * 4 + 1.000 * -10 - 0.1
EV = -10.1

Definitely don't want to proceed if the report was bad!

Rebuilding the tree:



EV of the test:

EV = 0.75 * -0.10 + 0.25 * -0.1
EV = -0.1

Don't buy the test. Wouldn't develop the land even if the test said it was clean. Chances are still too high that it is polluted.

Aside: What if you could test multiple times?

This analysis was not part of the exam but is useful in thinking about how an imperfect test can be used in practice.

		Prob After Test Number:					
site	report	0	1	2	3	Prob detect:	50%
D	D	25%	17%	10%	5.6%		
D	C	25%	17%	10%	5.6%		
C	D	0%	0%	0%	0%		
C	C	50%	67%	80%	89%		
check:		100%	100%	100%	100%		
p report C			75.0%	83.3%	90.0%		
cond p D			33.3%	20.0%	11.1%		
cond p C			66.7%	80.0%	88.9%		
p report D			25.0%	16.7%	10.0%		
cost of testing			0.1	0.2	0.3		
EV of develop when report C			**-0.77**	**1.00**	**2.14**		

5 light rail

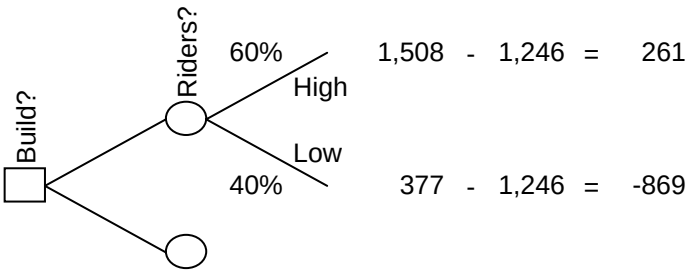
annual cost	100
years	20
int rate	5%

PV of annual cost forever	2,000
PV of annual costs after 20	754
PV of costs	1,246

high benefit	200
low benefit	50
prob high	60%

PV at 20 if high	4,000
PV at 0 if high	1,508

PV at 20 if low	1,000
PV at 0 if low	377



EV = 0.60 * 261 + 0.40 * -869 = -191

5b Rail just barely worthwhile for the p that sets EV = 0:

EV = p * 261 + (1-p) * -869 = 0
EV = p * 261 - 869 + p * 869 = 0
EV = p * 1,131 - 869 = 0

p = 869 / 1,131 = 0.77