Chapter Twelve: Decision Analysis

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PROBLEM SOLUTIONS

1. a) Lease land; maximum payoff = $90,000

b) Savings certificate; maximum of minimum payoffs = $10,000

2. a) Drive-in window; maximum payoff = $20,000

b) Breakfast; maximum of minimum payoffs= $4,000

3. a)

	Good	Recession
Bellhop	0	25,000
Management	35,000	0

Choose bellhop job.

b) Bellhop: 120,000(.4) + 60,000(.6) = $84,000; management: 85,000(.4) + 85,000(.6) = $85,000; select management job.

c) Bellhop: 120,000(.5) + 60,000(.5) = $90,000; management: 85,000(.5) + 85,000(.5) = 85,000; select bellhop job.

4. a) Course III, maximax payoff = A

b) Course I, maximin payoff = D

5. a) Plant corn; maximax payoff = \$35,000

b) Plant soybeans; maximin payoff = \$20,000

c)

	Pass	Fail
Corn	0	12,000
Peanuts	17,000	8,000
Soybeans	13,000	0

Plant corn; minimum regret = \$12,000

d) Corn: \$35,000(.3) + 8,000(.7) = \$16,100; peanuts: 18,000(.3) + 12,000(.7) = \$13,800; soybeans: 22,000(.3) + 20,000(.7) = \$20,600; plant soybeans.

e) Corn: 35,000(.5) + 8,000(.5) = \$21,500; peanuts: 18,000(.5) + 12,000(.5) = \$15,000; soybeans: 22,000(.5) + 20,000(.5) = \$21,000; plant corn.

6. Note that this payoff table is for costs.

a) Product 3, minimin payoff = \$3.00

b) Product 3, minimax payoff = \$6.50

7. a) Build shopping center; maximax payoff = \$105,000

b) Lease equipment; maximin payoff = \$40,000

c)

	Stable	Increase
Houses	35,000	10,000
Shopping center	0	20,000
Lease	65,000	0

Build shopping center.

d) Houses: \$70,000(.2) + 30,000(.8) = \$38,000; shopping center: \$105,000(.2) + 20,000(.8) = \$37,000; lease: \$40,000(.2) + 40,000(.8) = \$40,000; lease equipment.

e) Houses: 70,000(.5) + 30,000(.5) = \$50,000; shopping center: 105,000(.5) + 20,000(.5) = \$62,500; lease: 40,000(.5) + 40,000(.5) = \$40,000; build shopping center.

8. a) Purchase motel; maximax payoff = \$20,000

b) Purchase theater; maximin payoff = \$5,000

c)

	Shortage	Stable	Surplus
Motel	14,000	0	0
Restaurant	4,000	7,000	14,000
Theater	0	9,000	15,000

Select either motel or restaurant (both have minimum regret values of \$14,000).

d) Motel: 20,000(.4)— 8,000(.6) = \$3,200; restaurant: 8,000(.4) + 2,000(.6) = \$4,400; theater: 6,000(.4) + 5,000(.6) = \$5,400; select theater.

e) Motel: – 8,000(.33) + 15,000(.33) + 20,000(.33) = \$9,000; restaurant: 2,000(.33) + 8,000(.33) + 6,000(.33) = \$5,333; theater: 6,000(.33) + 6,000(.33) + 5,000(.33) = \$5,666; select motel.

9. a) LaPlace criterion:
EV(A|A) = 10.2(.33) + 7.3(.33) + 5.4(.33) = 7.6
EV(G|GT) = 9.6(.33) + 8.1(.33) + 4.8(.33) = 7.4
EV(A|N) = 12.5(33) + 6.5(.33) + 3.2(.33) = 7.3
Select Alabama vs. Auburn.

b) Select Alabama vs. Auburn; maximin payoff = 5.4

c) Select Army vs. Navy; maximax payoff = 12.5

10. a) Risk fund, maximax payoff = \$147,000

b) Savings bonds maximin payoff = \$30,000

c) Money market: 2(.2) + 3.1(.20) + 4(.2) + 4.3(.2) + 5(.2) = 36,000; stock growth: –3(.2) – 2(.2) + 2.5(.2) + 4(.2) + 6(.2) = 15,000; bond: 6(.2) + 5(.2) + 3(.2) + 3(.2) + 2(.2) = 38,000; government: 4(.2) + 3.6(.2) + 3.2(.2) + 3(.2) + 2.8(.2) = 33,200; risk: –9(.2) –4.5(.2) + 1.2(.2) + 8.3(.2) + 14.7(.2) = 21,400; savings bonds: 3(.2) + 3(.2) + 3.2(.2) + 3.4(.2) + 3.5(.2) = 32,200; select bond fund.

11.

	54	63	Wide Tackle	Nickel	Blitz
Off tackle	3	−2	9	7	−1
Option	−1	8	−2	9	12
Toss sweep	6	16	−5	3	14
Draw	−2	4	3	10	−3
Pass	8	20	12	−7	−8
Screen	−5	−2	8	3	16

a) Pass, maximax payoff = 20 yd

b) Either off tackle or option, maximin payoff = –2 yd

c) Off tackle: 3(.2) –2(.2) + 9(.2) + 7(.2) –1(.2) = 3.2; option: –1(.2) + 8(.2) –2(.2) + 9(.2) + 12(.2) = 5.2; toss sweep: 6(.2) + 16(.2) –5(.2) + 3(.2) + 14(.2) = 6.8; draw: –2(.2) + 4(.2) + 3(.2) + 10(.2) –3(.2) = 2.4; pass: 8(.2) + 20(.2) + 12(.2) –7(.2) –8(.2) = 5.0; screen: –5(.2) –2(.2) + 8(.2) + 3(.2) + 16(.2) = 4.0; use toss sweep.

12. a) *Minimin:*
South Korea 15.2
China 17.6
Taiwan 14.9

Philippines 13.8
Mexico 12.5 ← minimum
Select Mexico

b) *Minimax:*
South Korea 21.7
China 19.0 ← minimum
Taiwan 19.2
Philippines 22.5
Mexico 25.0
Select China

c) *Hurwicz (α = .40):*
South Korea: 15.2(.40) + 21.7(.60) = 19.10
China: 17.6(.40) + 19.0(.60) = 18.44
Taiwan: 14.9(.40) + 19.2(.60)
= 17.48 ← minimum
Philippines: 13.8(.40) + 22.5(.60) = 19.02
Mexico: 12.5(.40) + 25.0(.60) = 20.0
Select Taiwan

d) *Equal likelihood:*
South Korea: 21.7(.33) + 19.1(.33) + 15.2(.33) = 18.48
China: 19.0(.33) + 18.5(.33) + 17.6(.33) = 18.18
Taiwan: 19.2(.33) + 17.1(.33) + 14.9(.33) = 16.90 ← minimum
Philippines: 22.5(.33) + 16.8(.33) + 13.8(.33) = 17.52
Mexico: 25.0(.33) + 21.2(.33) + 12.5(.33) = 19.37
Select Taiwan

13. a) *Maximax criteria:*
Office park 4.5 ← maximum
Office building 2.4
Warehouse 1.7
Shopping center 3.6
Condominiums 3.2
Select office park

b) *Maximin criteria:*
Office park 0.5
Office building 1.5 ← maximum
Warehouse 1.0
Shopping center 0.7
Condominiums 0.6
Select office building

c) *Equal likelihood*
Office park: 0.5(.33) + 1.7(.33) + 4.5(.33) = 2.21 ← maximum
Office building: 1.5(.33) + 1.9(.33) + 2.4(.33) = 1.91
Warehouse: 1.7(.33) + 1.4(.33) + 1.0(.33) = 1.35
Shopping center: 0.7(.33) + 2.4(.33) + 3.6(.33) = 2.21 ← maximum
Condominiums: 3.2(.33) + 1.5(.33) + 0.6(.33) = 1.75
Select office park or shopping center

d) *Hurwicz criteria* (α = .3)
Office park: 4.5(.3) + 0.5(.7) = 1.70
Office building: 2.4(.3) + 1.5(.7) = 1.77 ← maximum
Warehouse: 1.7(.3) + 1.0(.7) = 1.21
Shopping center: 3.6(.3) + 0.7(.7) = 1.57
Condominiums: 3.2(.3) + 0.6(.7) = 1.38
Select office building

14. a) Maximax = Gordan

b) Maximin = Johnson

c) Hurwicz (α = .60)

Byrd = 4.4(.6) + (–3.2)(.4) = $1.36M
O'Neil = 6.3(.6) + (–5.1)(.4) = $1.74M
Johnson = 5.8(.6) + (–2.7)(.4) = $2.40M
Gordan = 9.6(.6) + (–6.3)(.4) = $3.24M
Select Gordan

d) Equal likelihood

Byrd = 4.4(.33) + (1.3)(.33) + (–3.2)(.33) = +$0.83M
O'Neil = 6.3(.33) + (1.8)(.33) + (–5.1)(.33) = +$.99M
Johnson = 5.8(.33) + (0.7)(.33) + (–2.7)(.33) = +$1.254M
Gordan = 9.6(.33) + (–1.6)(.33) + (–6.3)(.33) = $.561M
Select Johnson

15. EV(press) = 40,000(.4) – 8,000(.6) = $11,200; EV(lathe) = 20,000(.4) + 4,000(.6) = $10,400; EV(grinder) = 12,000(.4) + 10,000(.6) = $10,800; purchase press.

16. a) EV(sunvisors) = –500(.3) –200(.15) + 1500(.55) = $645; EV(umbrellas) = 2,000(.3) + 0(.15) – 900(.55) = $105; carry sunvisors.

b) Opportunity loss table:

	Rain	**Overcast**	**Sunshine**
Sunvisors	2,500	200	0
Umbrellas	0	0	2,400

EOL(sunvisors) = 2,500(.3) + 200(.15) + 0 = $780; EOL(umbrellas) = 0 + 0 + 2,400(.55) = $1,320; select sunvisors since it has the minimum expected regret.

17. EV (snow shoveler) = $30(.13) + 60(.18) + 90(.26) + 120(.23) + 150(.10) + 180(.07) + 210(.03) = $99.60

The cost of the snow blower ($625) is much more than the annual cost of the snow shoveler, thus on the basis of one year the snow shoveler should be used. However, the snow blower could be used for an extended period of time such that after approximately six years the cost of the snow blower would be recouped. Thus, the decision hinges on weather or not the decision maker thinks 6 years is too long to wait to recoup the cost of the snow blower.

18. a) EV(widget) = 120,000(.2) + 70,000(.7) –30,000(.1) = \$70,000; EV(hummer) = 60,000(.2) + 40,000(.7) + 20,000(.1) = \$42,000; EV(nimnot) = 35,000(.2) + 30,000(.7) + 30,000(.1) = \$31,000; introduce widget.

b)

	Favorable	Stable	Unfavorable
Widget	0	0	60,000
Hummer	60,000	30,000	10,000
Nimnot	85,000	40,000	0

EOL(A) = 0 + 0 + 60,000(.1) = \$6,000; EOL(B) = 60,000(.2) + 30,000(.7) + 10,000(.1) = \$34,000; EOL(C) = 85,000(.2) + 40,000(.7) + 0 = \$45,000; select A (widget).

c) Expected value given perfect information = 120,000(.2) + 70,000(.7) + 30,00()(.1) = 76,000; EVPI = 76,000— EV(widget) = 76,000—70,000 = \$6,000; the company would consider this a maximum, and since perfect information is rare, it would pay less than \$6,000 probably.

19. EV(operate) = 120,000(.4) + 40,000(.2) + (–40,000)(.4) = \$40,000; leasing = \$40,000; if conservative, the firm should lease. Although the expected value for operating is the same as leasing, the lease agreement is not subject to uncertainty and thus does not contain the potential \$40,000 loss. However, the risk taker might attempt the \$120,000 gain.

20. To be indifferent, the expected value for the investments would equal each other: EV(stocks) = EV(bonds). Next, let the probability of good economic conditions equal p and the probability of bad conditions equal $1 - p$:

$$\text{EV(stocks)} = 10{,}000(p) + -4{,}000(1-p)$$
$$\text{EV(bonds)} = 7{,}000(p) + 2{,}000(1-p)$$
$$\text{EV(stocks)} = \text{EV(bonds)}$$
$$10{,}000(p) + (-4{,}000)(1-p) = 7{,}000(p) + 2{,}000(1-p)$$
$$10{,}000p - 4{,}000 + 4{,}000p = 7{,}000p + 2{,}000 - 2{,}000p$$
$$9{,}000p = 6{,}000$$
$$p = .667$$

Therefore, probability of good conditions = p =.667, probability of bad conditions = $1 - p$ = .333.

21. EV(money market) = 2(.2) + 3.1(.3) + 4(.3) + 4.3(.1) + 5(.1) = 34,600; EV(stock growth) = –3(.2) – 2(.3) + 2.5(.3) + 4(.1) + 6(.1) = 5,500: EV(bond) = 6(.2) + 5(.3) + 3(.3) + 3(.1) + 2(.1) = 41,000; EV(government) = 4(.2) + 3.6(.3) 3.2(.3) + 3(.1) + 2.8(.1) = 34,200; EV(risk) = –9(.2) – 4.5(.3) + 1.2(.3) + 8.3(.1) + 14.7(.1) = –49,000; EV(savings bonds) = 3(.2) + 3(.3) 3.2(.3) + 3.4(.1) + 3.5(.1) = 31,500; purchase bond fund.

22. a) EV(off tackle) = 3(.4) – 2(.10) + 9(.20) + 7(.20) – 1(. 10) = 4.10; EV(option) = -1(.4) + 8(.10) – 2(.20) + 9(.2) + 12(.10) = 3; EV(toss sweep) = 6(.4) + 16(.10) – 5(.20) + 3(.20) + 14(.10) = 5.0; EV(draw) = – 2(.4) + 4(.10) + 3(.20) + 10(.20) - 3(.10) = 1.9; EV(pass) = 8(.4) + 20(.10) + 12(.20) – 7(.20) – 8(.10) = 5.4; EV(screen) = – 5(.4) – 2(.10) + 8(.20) + 3(.20) + 16(.10) = 1.6; PASS is best, followed by toss sweep, off tackle, option, draw, and screen.

b) EV(off tackle) = 3(.10) – 2(.10) + 9(.10) + 7(.10) – 1(.60) = 1.1; EV(option)= –1(.10) + 8(.10) – 2(.10) + 9(.10) + 12(.60) = 8.6; EV(toss sweep) = 6(.10) + 16(.10) – 5(.10) + 3(.10) + 14(.60) = 10.4; EV(draw) = – 2(.10) + 4(.10) + 3(.10) + 10(.10) – 3(.60) = –.3; EV(pass) = 8(.10) + 20(.10) + 12(.10) – 7(.10) – 8(.60) = –1.5; EV(screen) = – 5(.10) – 2(.10) + 8(.10) + 3(.10) + 16(.60) = 10.0; select toss sweep. Yes, it is likely Tech will make the first down.

23. EV (South Korea) = 21.7(.40) + 19.1(0.5) + 15.2(.10) =19.75
EV (China) = 19.0(.40) + 18.5(.50) + 17.6(.10) = 18.61
EV (Taiwan) = 19.2(.40) + 17.1(.50) + 14.9(.10) = 17.72 ← minimum
EV (Philippines) = 22.5(.40) + 16.8(.50) + 13.8(.10) = 18.78
EV (Mexico) = 25.0(.40) + 21.2(.50) + 12.5(.10) = 21.85
Select Taiwan
Expected value of perfect information = 19(.40) + 16.8(.50) + 12.5(.10) = 17.25
EVPI = 17.25 – 17.72
= \$-0.47 million

The EVPI is the maximum amount the *cost* of the facility could be reduced (\$0.47 million) if perfect information can be obtained.

24. a) EV (Office park) = .5(.50) + 1.7(.40) + 4.5(.10) = 1.38
EV (Office building) = 1.5(.50) + 1.9(.40) + 2.4(.10) = 1.75

EV (Warehouse) = 1.7(.50) + 1.4(.40) + 1.0(.10) = 1.51
EV (Shopping center) = 0.7(.50) + 2.4(.40) + 3.6(.10) = 1.67
EV (Condominiums) = 3.2(.50) + 1.5(.40) + .06(.10) = 2.26 ← maximum
Select Condominium project

b) EVPI = Expected value of perfect information – expected value without perfect information = 3.01 – 2.26
EVPI = $0.75 million

25. Using expected value; EV(compacts) = 300,000(.6) + 150,000(.4) = $240,000; EV(full-sized) = –100,000(.6) + 600,000(.4) = $180,000; EV(trucks) = 120,000(.6) + 170,000(.4) = $140,000; select the compact car dealership.

26. Payoff matrix:

	Demand				
	20	**21**	**22**	**23**	**24**
Stock (lb)	**.10**	**.20**	**.30**	**.30**	**.10**
20	$20.00	$20.00	$20.00	$20.00	$20.00
21	18.50	21.00	21.00	21.00	21.00
22	17.00	19.50	22.00	22.00	22.00
23	15.50	18.00	20.50	23.00	23.00
24	14.00	16.50	19.00	21.50	24.00

EV(20) = $20.00/; EV(21) = 18.50(.1) + 21.00(.2) + 21.00(.3) + 21.00(.3) + 21.00(.1) = $20.75; EV(22) = 17.00(.1) + 19.50(.2) + 22.00(.3) + 22.00(.3) + 22.00(.1) = $21.00; EV(23) = 15.50(.1) + 18.00(.2) + 20.50(.3) + 23.00(.3) + 23.00(.1) = $20.50; EV(24) = 14.00(.1) + 16.50(.2) + 19.00(.3) + 21.50(.3) + 24.00(.1) = $19.25; stock 22 lb.

27. Revenue and cost data: sales revenue = $12.00/case; cost = $10/case; salvage for unsold cases = $2/case; shortage cost = $4/case

a) Payoff matrix:

	Demand			
Stock	**15**	**16**	**17**	**18**
Milk Cases	**.20**	**.25**	**.40**	**.15**
15	$30	$26	$22	$18
16	22	32	28	24
17	14	24	34	30
18	6	16	26	36

b) EV(15) = 30(.2) + 26(.25) + 22(.4) + 18(.15) = $24.00; EV(16) = 22(.2) + 32(.25) + 28(.4) + 24(.15) = $27.20; EV(17) = 14(.2) + 24(.25) + 34(.4) + 30(.15) = $26.90; EV(18) = 6(.2) + 16(.25) + 26(.4) + 36(.15) = $21.00; stock 16 cases.

c) Opportunity loss table:

	15	**16**	**17**	**18**
15	0	6	12	18
16	8	0	6	12
17	16	8	0	6
18	24	16	8	0

EOL(15) = 0(.2) + 6(.25) + 12(.4) + 18(.15) = $9.00; EOL(16) = 8(.2) + 0(.25) + 6(.4) + 12(.15) = $5.80; EOL(17) = 16(.2) + 8(.25) + 0(.4) + 6(.15) = $6.10; EOL(18) = 24(.2) + 16(.25) + 8(.4) + 0(.15) = $12.00; stock 16 cases.

d) Expected value with perfect information = $30(.2) + 32(.25) + 34(.4) + 36(.15) = $33; EVPI = 33 – EV(16) = 33 – 27.20 = $5.80

28. a) Payoff matrix:

	Demand					
	.10	**.15**	**.30**	**.20**	**.15**	**.10**
Stock (boxes)	**25**	**26**	**27**	**28**	**29**	**30**
25	50	50	50	50	50	50
26	49	52	52	52	52	52
27	48	51	54	54	54	54
28	47	50	53	56	56	56
29	46	49	52	55	58	58
30	45	48	51	54	57	60

b) EV(25) = 50(.10) + 50(.15) + 50(.30) + 50(.20) + 50(.15) + 50(.10) = 50.0; EV(26) = 49(.10) + 52(.15) + 52(.30) + 52(.20) + 52(.15) + 52(.10) = 51.7; EV(27) = 48(.10) + 51(.15) + 54(.30) + 54(.20) + 54(.15) + 54(.10) = 52.95; EV(28) = 47(.10) + 50(.15) + 53(.30) + 56(.20) + 56(.15) + 56(.10) = 53.3; EV(29) = 46(.10) + 49(.15) + 52(.30) + 55(.20) + 58(.15) + 58(.10) = 53.05; EV(30) = 45(.10) + 48(.15) + 51(.30) + 54(.20) + 57(.15) + 60(.10) = 52.35; since EV(28) = $53.30 is the maximum, 28 boxes of Christmas cards should be stocked.

c) Compute expected value under certainty: EV= 50(.10) + 52(.15) + 54(.30) + 56(.20) + 58(.15) + 60(.10) = $54.90; EVPI = $54.90 – $53.30 = $1.60

29. a) Payoff matrix:

	Demand					
	.05	**.10**	**.25**	**.30**	**.20**	**.10**
Stock (dozens)	**20**	**22**	**24**	**26**	**28**	**30**
20	20.00	18.00	16.00	14.00	12.00	10.00
22	17.50	22.00	20.00	18.00	16.00	14.00
24	15.00	19.50	24.00	22.00	20.00	18.00
26	12.50	17.00	21.50	26.00	24.00	22.00
28	10.00	14.50	19.00	23.50	28.00	26.00
30	7.50	12.00	16.50	21.00	25.50	30.00

b) EV(20) = 20.00(.05) + 18.00(.10) + 16.00(.25) + 14.00(.30) + 12.00(.20) + 10.00(.10) = \$14.40; EV(22) = 17.50(.05) + 22.00(.10) + 20.00(.25) + 18.00(.30) + 16.00(.20) + 14.00(.10) = \$18.08; EV(24) = 15.00(.05) + 19.50(.10) + 24.00(.25) + 22.00(.30) + 20.00(.20) + 18.00(.10) = \$21.10; EV(26) = 12.50(.05) + 17.00(.10) + 21.50(.25) + 26.00(.30) + 24.00(.20) + 22.00(.10) = \$22.50; EV(28)= 10.00(.05) + 14.50(.10) + 19.00(.25) + 23.50(.30) + 28.00(.20) + 26.00(.10) = \$21.95; EV(30) = 7.50(.05) + 12.00(.10) + 16.50(.25) + 21.00(.30) + 25.50(.20) + 30.00(.10) = \$20.10; since EV(26) = \$22.50 is the maximum, the green house owner should grow 26 dozen carnations.

c) Opportunity cost table:

	Demand					
	.05	**.10**	**.25**	**.30**	**.20**	**.10**
Stock (dozens)	**20**	**22**	**24**	**26**	**28**	**30**
20	0	4.00	8.00	12.00	16.00	20.00
22	2.50	0	4.00	8.00	12.00	16.00
24	5.00	2.50	0	4.00	8.00	12.00
26	7.50	5.00	2.50	0	4.00	8.00
28	10.00	7.50	5.00	2.50	0	4.00
30	12.50	10.00	7.50	5.00	2.50	0

EOL(20) = 0(.05) + 4.00(.10) + 8.00(.25) + 12.00(.30) + 16.00(.20) + 20.00(.10) = \$11.20; EOL(22) = 2.50(.05) + 0(.10) + 4.00(.25) + 8.00(.30) + 12.00(.20) + 16.00(.10) = \$7.53; EOL(24) = 5.00(.05) + 2.50(.10) + 0(.25) + 4.00(.30) + 8.00(.20) + 12.00(.10) = \$4.50; EOL(26) = 7.50(.05) + 5.00(.10) + 2.50(.25) + 0(.30) + 4.00(.20) + 8.00(.10) = \$3.10; EOL(28) = 10.00(.05) + 7.50(.10) + 5.00(.25) + 2.50(.30) + 0(.20) + 4.00(.10) = \$3.65; EOL(30) = 12.50(.05) + 10.00(.10) + 7.50(.25) + 5.00(.30) + 2.50(.20) + 0(.10) = \$5.50; since EOL(26) = \$3.10 is the minimum, 26 dozen carnations should be grown.

d) The expected value under certainty: EV = \$20.00(.05) + 22.00(.10) + 24.00(.25) + 26.00(.30) + 28.00(.20) + 30.00(.10) = \$25.60; EVPI = \$25.60 – 22.50 = \$3.10

30. a) Stock 25, maximum of minimum payoffs = \$50

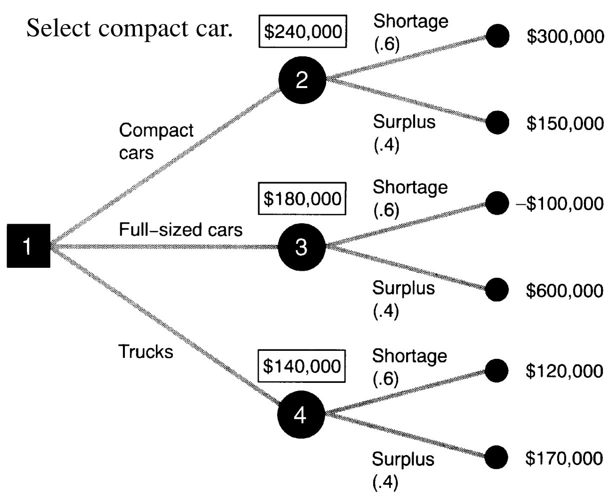
b) Stock 30, maximum of maximum payoffs = \$60

c) 25: 50(.4) + 50(.6) = 50; 26: 52(.4) + 49(.6) = 50.2; 27: 54(.4) + 48(.6) = 50.4; 28: 56(.4) + 47(.6) = 50.6; 29: 58(.4) + 46(.6) = 50.8; 30: 60(.4) + 45(.6) = 51; stock 30 boxes.

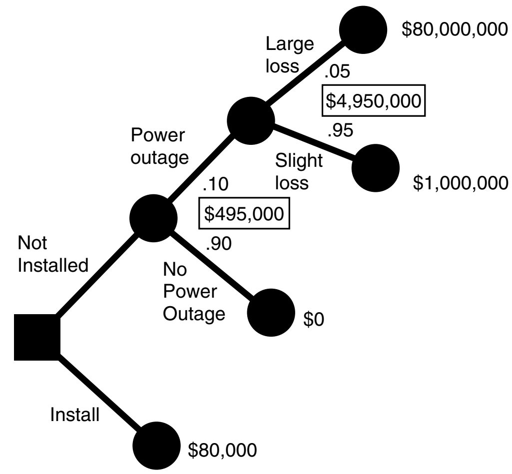
d) Stock 28 or 29 boxes; minimum regret = \$4.

31. EV(Byrd) = (–3.2)(.15) + (1.3)(.55) + (4.4)(.30) = \$1.56M
EV (O'Neil) = (–5.1)(.18) + (1.8)(.26) + (6.3)(.56) = \$3.08M
EV (Johnson) = (–2.7)(.21) + (0.7)(.32) + (5.8)(.47) = \$2.38M
EV (Gordan) = (–6.3)(.30) + (1.6)(.25) + (9.6)(.45) = \$2.03M
Select O'Neil

32. Select compact car.

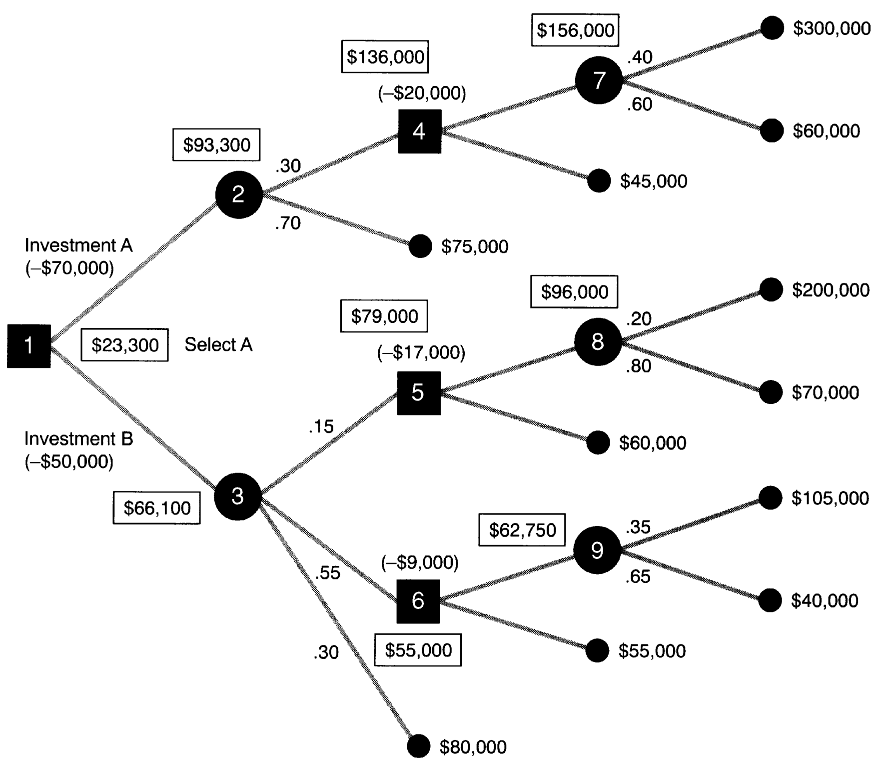


34.

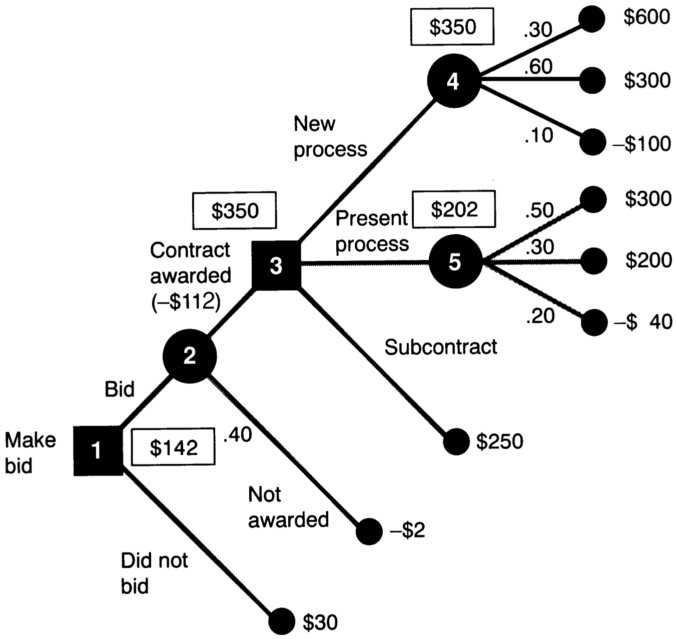


Since cost of installation ($800,000) is greater than expected value of not installing ($495,000), do not install an emergency power generator

33.



35.



36. $P(\text{c})$ = probability of contract = .40; $P(\text{n})$ = probability of no contract = .60; $P(\text{f}|\text{c}) = .70$; $P(\text{u}|\text{c}) = .30$; $P(\text{u}|\text{n}) = .80$; $P(\text{f}|\text{n}) = .20$

$$P(\text{c}|\text{f}) = \frac{P(\text{f}|\text{c})P(\text{c})}{P(\text{f}|\text{c})P(\text{c}) + P(\text{f}|\text{n})P(\text{n})} = \frac{(.70)(.40)}{(.70)(.40) + (.20)(.60)} = .70$$

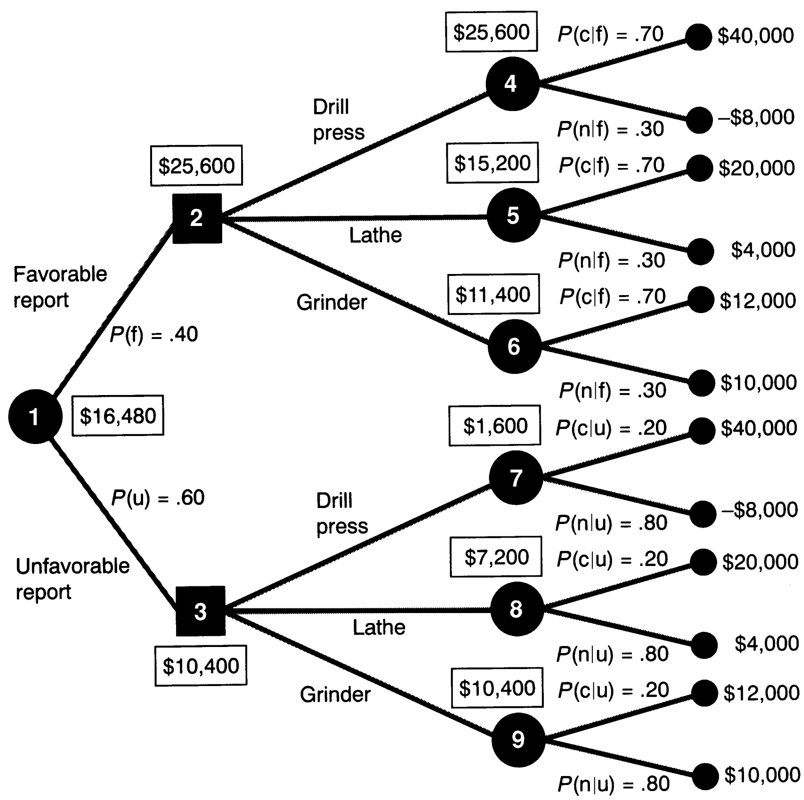
$$P(\text{f}) = P(\text{f}|\text{c})P(\text{c}) + P(\text{f}|\text{n})P(\text{n}) = (.70)(.40) + (.20)(.60) = .40$$

$$P(\text{n}|\text{f}) = \frac{P(\text{f}|\text{n})P(\text{n})}{P(\text{f}|\text{n})P(\text{n}) + P(\text{f}|\text{c})P(\text{c})} = \frac{(.20)(.60)}{(.20)(.60) + (.70)(.40)} = .30$$

$$P(\text{n}|\text{u}) = \frac{P(\text{u}|\text{n})P(\text{n})}{P(\text{u}|\text{n})P(\text{n}) + P(\text{u}|\text{c})P(\text{c})} = \frac{(.80)(.60)}{(.80)(.60) + (.30)(.40)} = .80$$

$$P(\text{u}) = P(\text{u}|\text{n})P(\text{n}) + P(\text{u}|\text{c})P(\text{c}) = (.80)(.60) + (.30)(.40) = .60$$

$$P(\text{c}|\text{u}) = \frac{P(\text{u}|\text{c})P(\text{c})}{P(\text{u}|\text{c})P(\text{c}) + P(\text{u}|\text{n})P(\text{n})} = \frac{(.30)(.40)}{(.30)(.40) + (.80)(.60)} = .20$$



Decision strategy: If report is favorable, purchase a lathe. If report is unfavorable, purchase a grinder. EV (strategy) = \$16,480; EVSI = $EV_{\text{with information}}$ − $EV_{\text{without information}}$ = \$16,480 − 11,200 = \$5,280

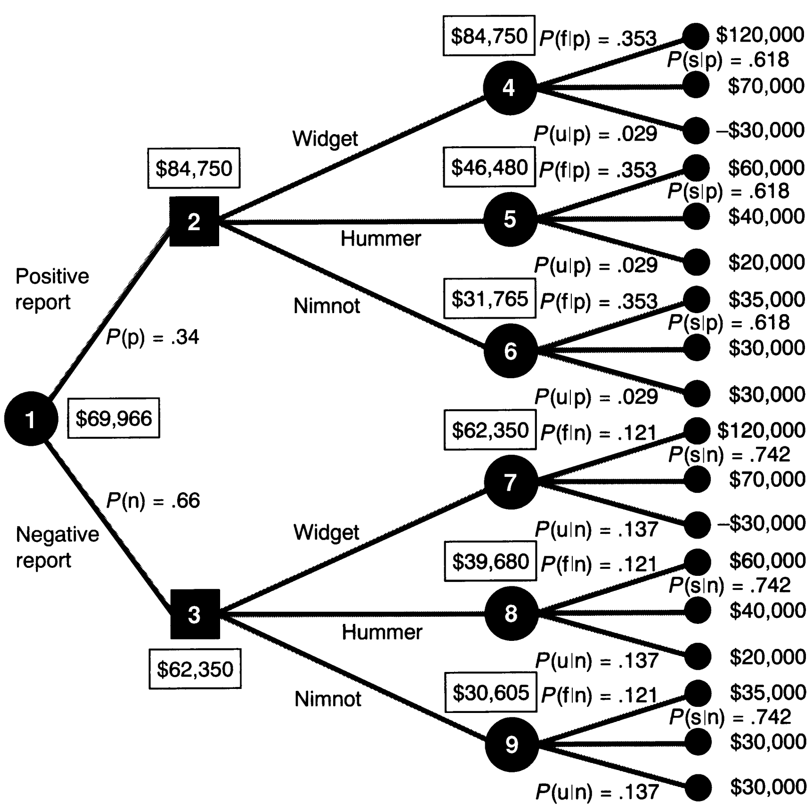
37. P(f) = favorable market conditions = .2; P(s) = stable market conditions = .7; P(u) = unfavorable market conditions = .1; P(p|f) = .60; P(n|f) = .40; P(p|s) = .30; P(n|s) = .70; P(p|u) = .10; P(n|u) = .90

Posterior probability table for a positive report:

(1) States of Nature	(2) Prior Probabilities	(3) Conditional Probabilities	(4) (2) × (3)	(5) Posterior Probabilities (4) ÷ Σ(4)
Favorable	P(f) = .2	P(p|f) = .60	.12	P(f|p) = .12/.34 = .353
Stable	P(s) = .7	P(p|s) = .30	.21	P(s|p) = .21/.34 = .618
Unfavorable	P(u) = .1	P(p|u) = .10	.01	P(u|p) = .01/.34 = .029
			P(p) = .34	

Posterior probability table for a negative report:

(1) States of Nature	(2) Prior Probabilities	(3) Conditional Probabilities	(4) (2) × (3)	(5) Posterior Probabilities (4) ÷ Σ(4)
Favorable	P(f) = .2	P(n|f) = .40	.08	P(f|n) = .08/.66 = .121
Stable	P(s) = .7	P(n|s) = .70	.49	P(s|n) = .49/.66 = .742
Unfavorable	P(u) = .1	P(n|u) = .90	.09	P(u|n) = .09/.66 = .137
			P(n) = .66	



Decision strategy: Produce the widget regardless of the report. EV(strategy) = \$69,966; EVSI = $EV_{\text{with information}}$ − $EV_{\text{without information}}$ = \$69,966 − \$70,000 ≈ 0. Additional information has no value, since the owner will produce the widget in either case.

38. Let s^- = shortage; s^+ = surplus; $P(s^-)$ = .6; $P(s^+)$ = .4. Let S^- = report of shortage; S^+ = report of surplus; $P(S^-|s^-)$ = .90; $P(S^+|s^-)$ = .10; $P(S^+|s^+)$ = .70; $P(S^-|s^+)$ = .30.

$$P(s^-|S^-) = \frac{P(S^-|s^-)P(s^-)}{P(S^-|s^-)P(s^-) + P(S^-|s^+)P(s^+)}$$

$$= \frac{(.90)(.60)}{(.90)(.60) + (.30)(.40)}$$

$$P(S^-) = .66 = .818$$

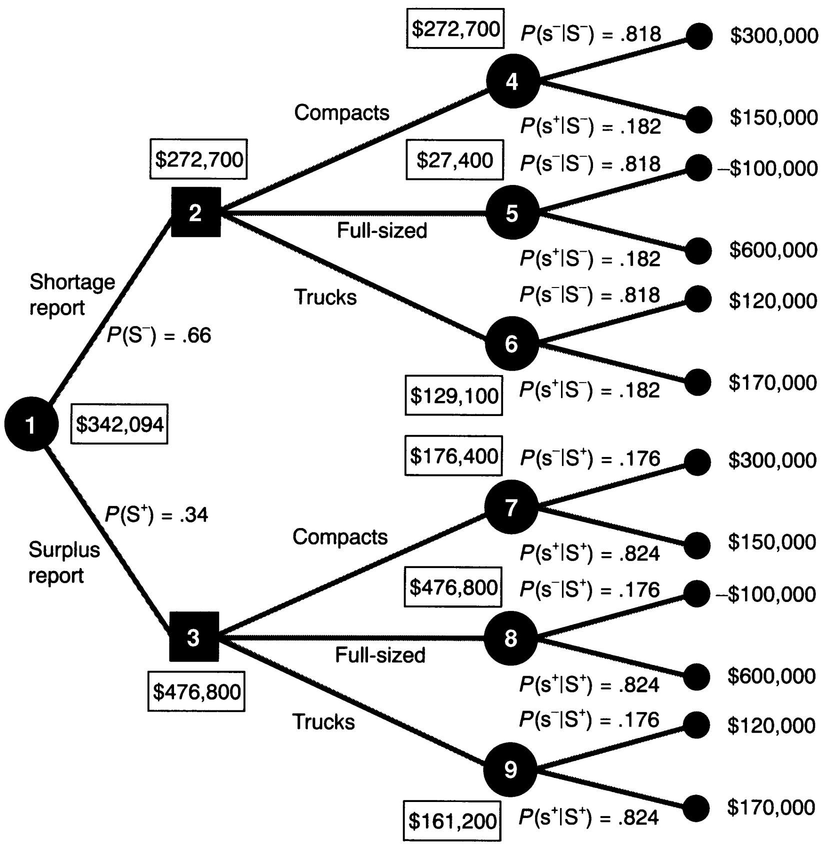
$$P(s^+|S^-) = 1 - .818 = .182$$

$$P(s^+|S^+) = \frac{P(S^+|s^+)P(s^+)}{P(S^+|s^+)P(s^+) + P(S^+|s^-)P(s^-)}$$

$$= \frac{(.70)(.40)}{(.70)(.40) + (.10)(.60)}$$

$$P(S^+) = .34 = .824$$

$$P(s^-|S^+) = 1 - .824 = .176$$



Decision strategy: If the report indicates a gas shortage, stock compacts. If the report indicates a surplus, stock full-sized cars. EV(strategy) = \$342,094; EVSI = $EV_{\text{with information}} - EV_{\text{without information}}$ = \$342,094 − \$240,000 = \$102,094

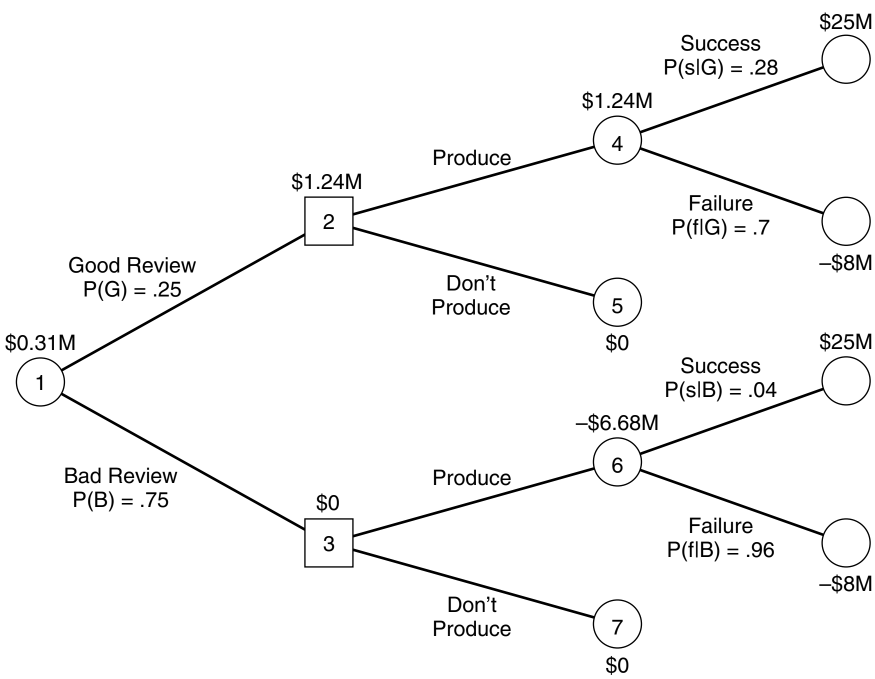
b. Expected value *given* perfect information = 300,000(.6) + 600,00(4) = \$420,000; EVPI = \$420,000 – 240,000 = \$180,000; EVSI = \$102,094; efficiency = EVSI/EVPI = \$102,094/\$180,000 = .51 or 51%

39. P(s) = .10
P(f) = .90
G = good review
B = bad review
P(G|s) = .70
P(B|s) = .30
P(G|f) = .20
P(B|f) = .80

$$P(s|G) = \frac{P(G|s)\,P(s)}{P(G|s)\,P(s) + P(G|f)\,P(f)}$$

$$= \frac{(.70)(.10)}{(.70)(.10) + (.20)(.90)} = .28$$

P(f|G) = .72
P(s|B) = .04 P(G) = .25
P(f|B) = .96 P(B) = .75

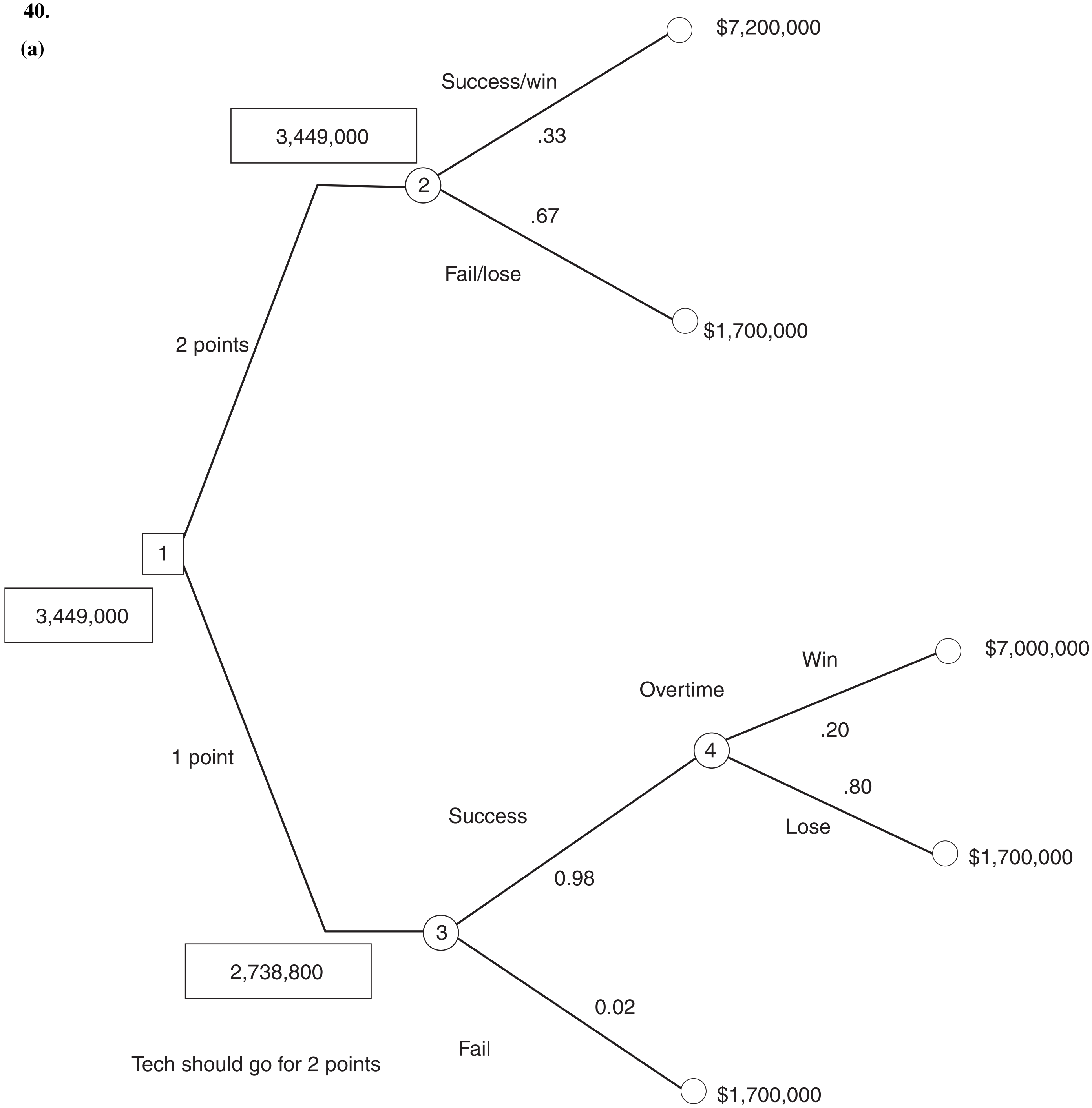


$EVSI = EV_{\text{with information}} - EV_{\text{w/o information}}$
= \$0.31M – (–4.7M)
= \$5.01M

Hire Sickel; if good review produce, if bad review don't produce

40.

(a)



(b) $.98[7.0x + 1.7(1-x)] + (0.2)(1.7) = 3.449$

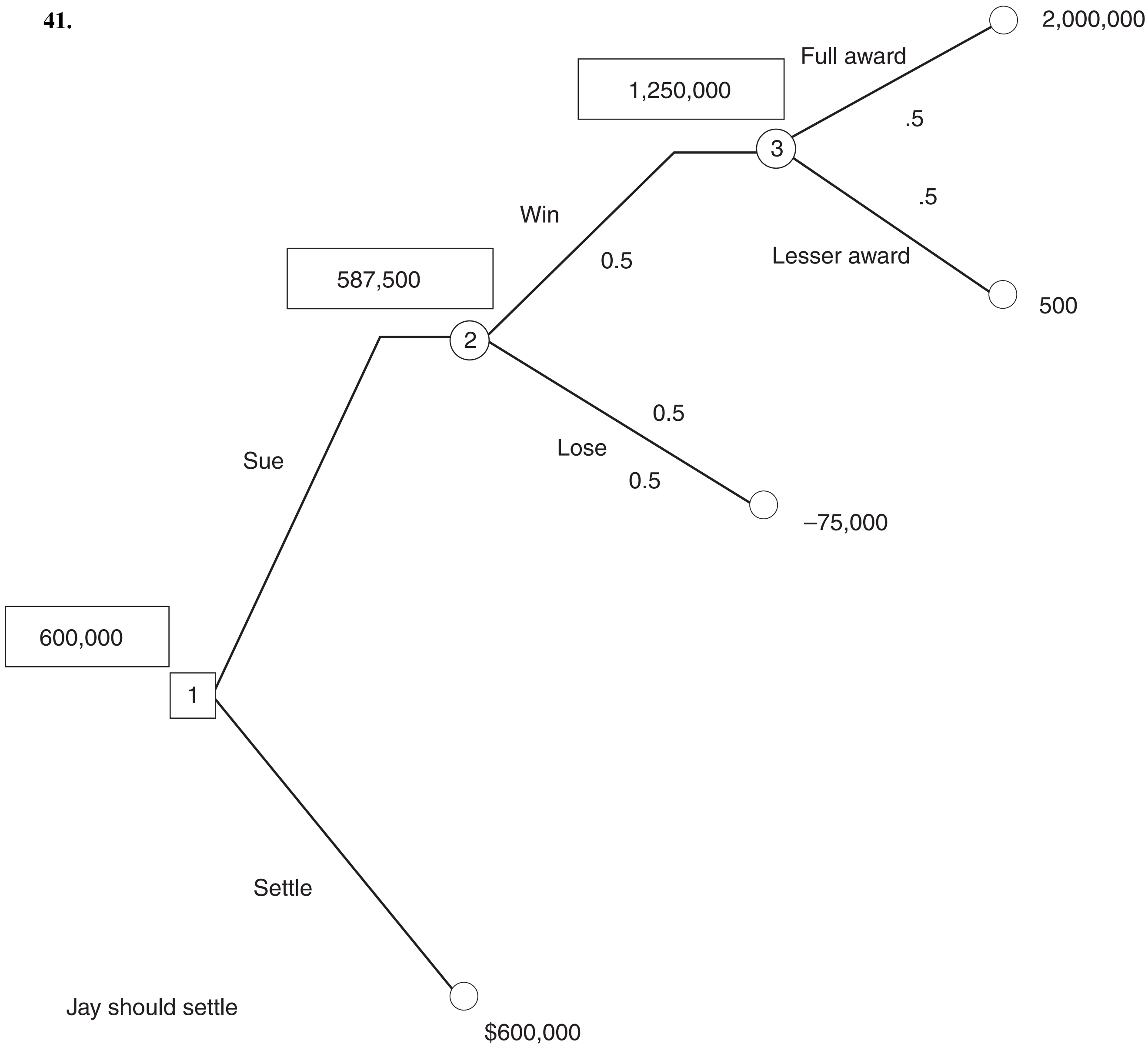
$.98[5.3x + 1.7) + .034 = 3.449$

$5.194x + 1.666 + .034 = 3.449$

$5.194x = 1.749$

$x = .3367$ probability of winning in overtime

41.



Jay should settle

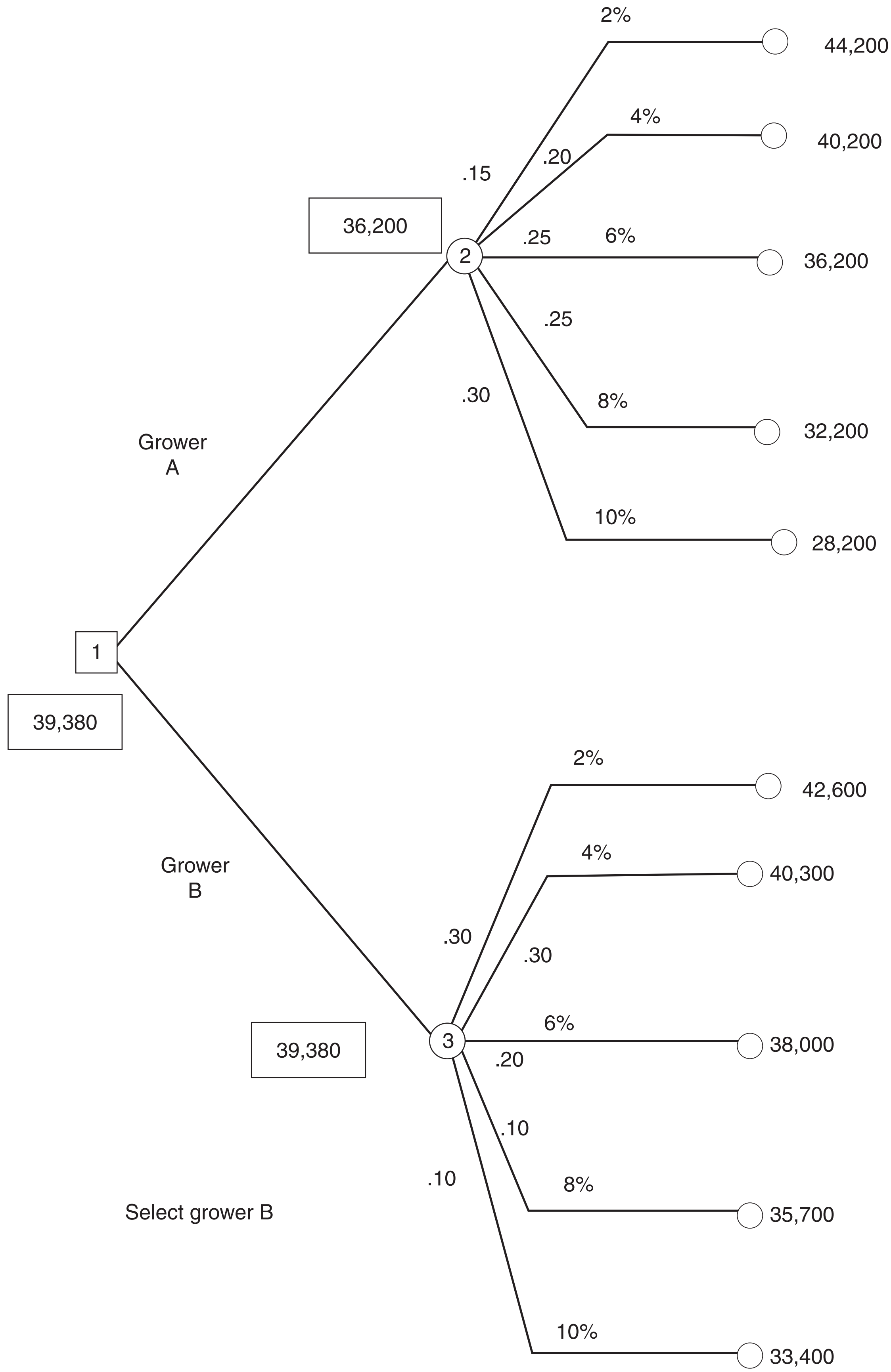
42. The following table includes the medical costs for all the final nodes in the decision tree.

Expense	Plan 1	Plan 2	Plan 3
100	484	160	388
500	884	560	438
1,500	984	1,290	738
3,000	1,134	1,440	1,188
5,000	1,334	1,640	1,788
10,000	1,834	2,140	3,288

E(1) = 954
E(2) = 976.5
E(3) = 820.5

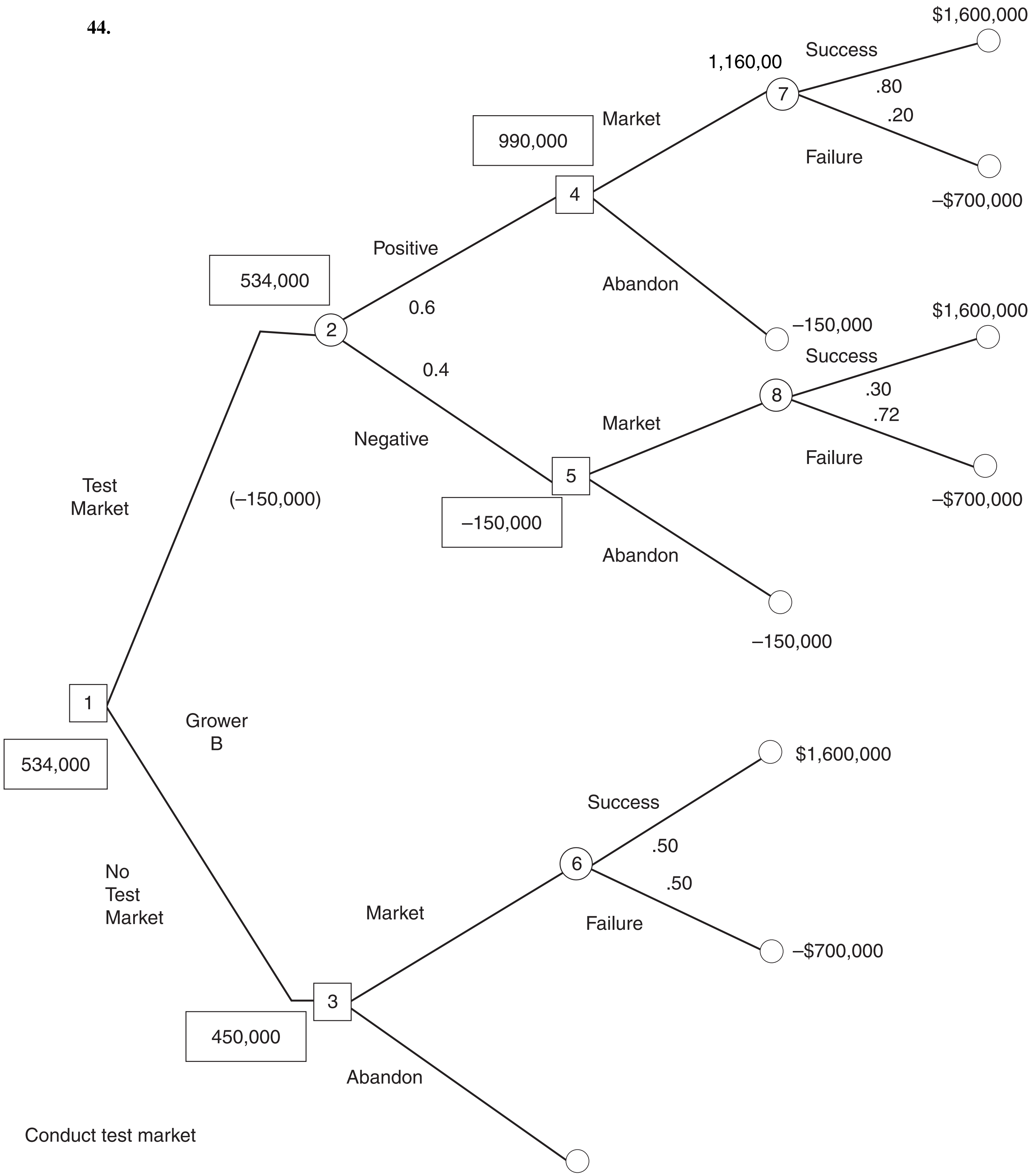
Select plan 3

43.



1
39,380
Grower
A
36,200
2
.15
.20
.25
.25
.30
2%
4%
6%
8%
10%
44,200
40,200
36,200
32,200
28,200
Grower
B
39,380
3
.30
.30
.20
.10
.10
2%
4%
6%
8%
10%
42,600
40,300
38,000
35,700
33,400
Select grower B

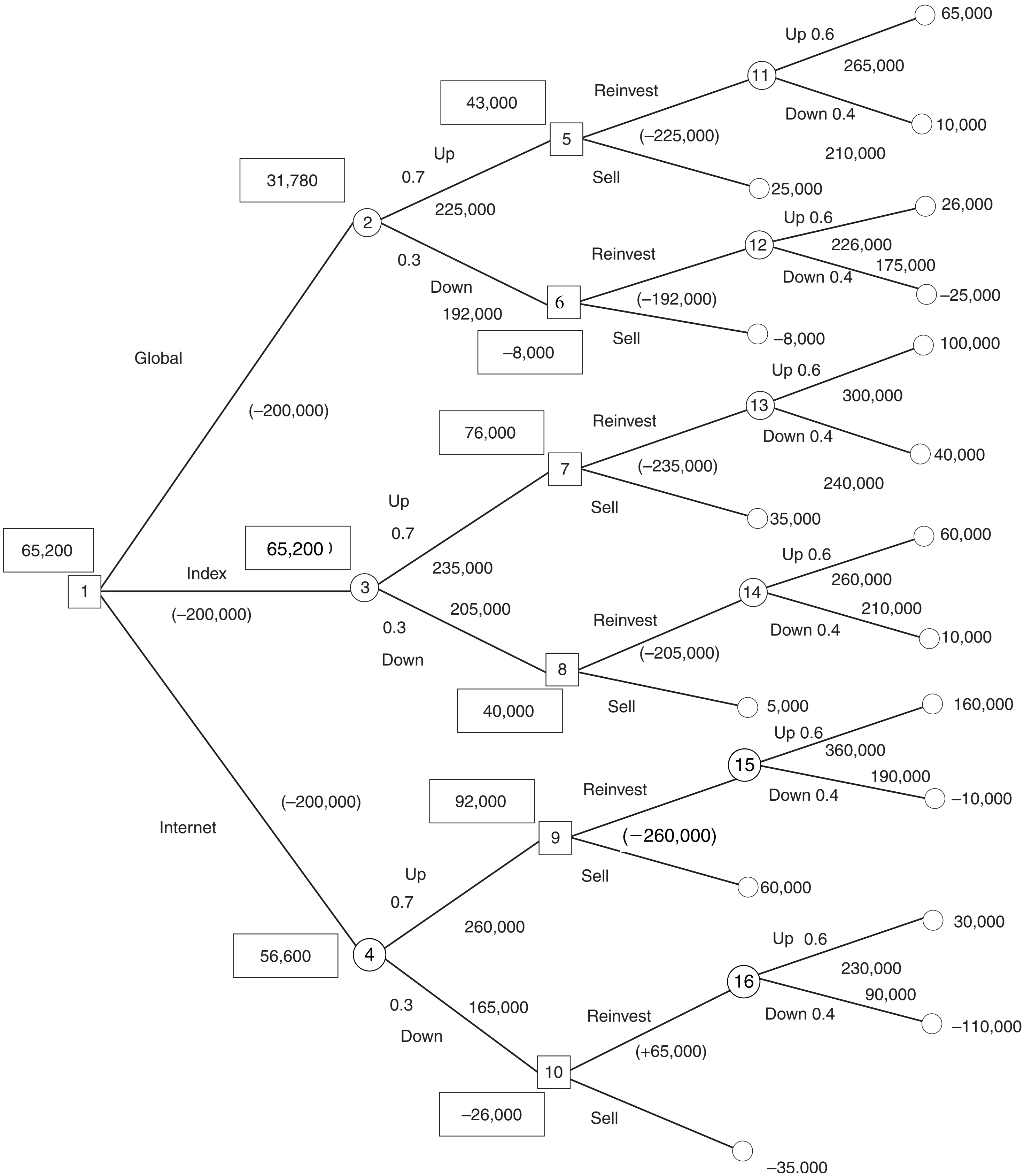
44.



45. The EV without the test market is $450,000, which is $84,000 less than the EV wih the test market. Since the cost of the test market is $150,000,

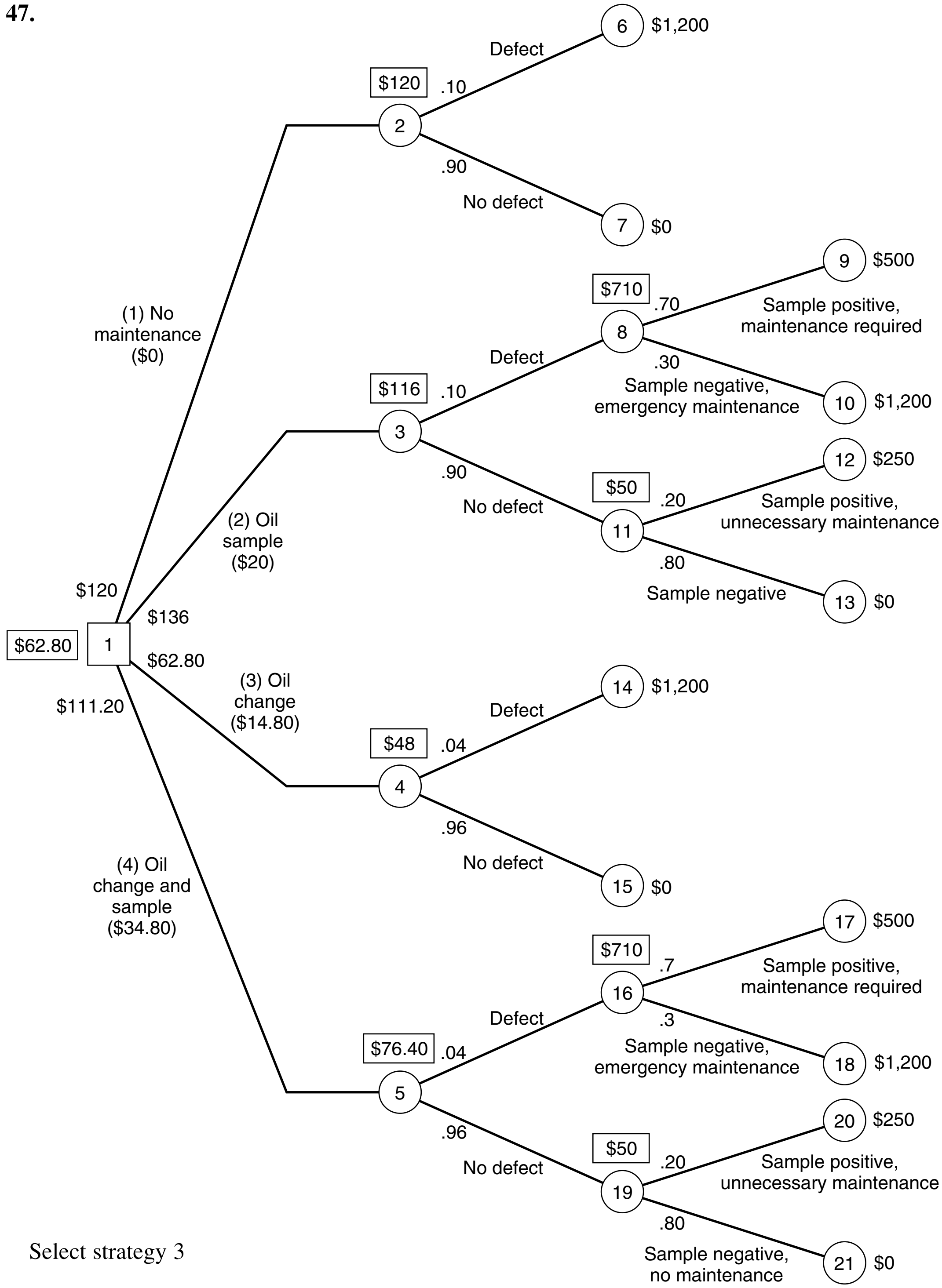
EVSI = $150,000 + 84,000 = $234,000
EVPI = $800,000 + 450,000 = $350,000

46.



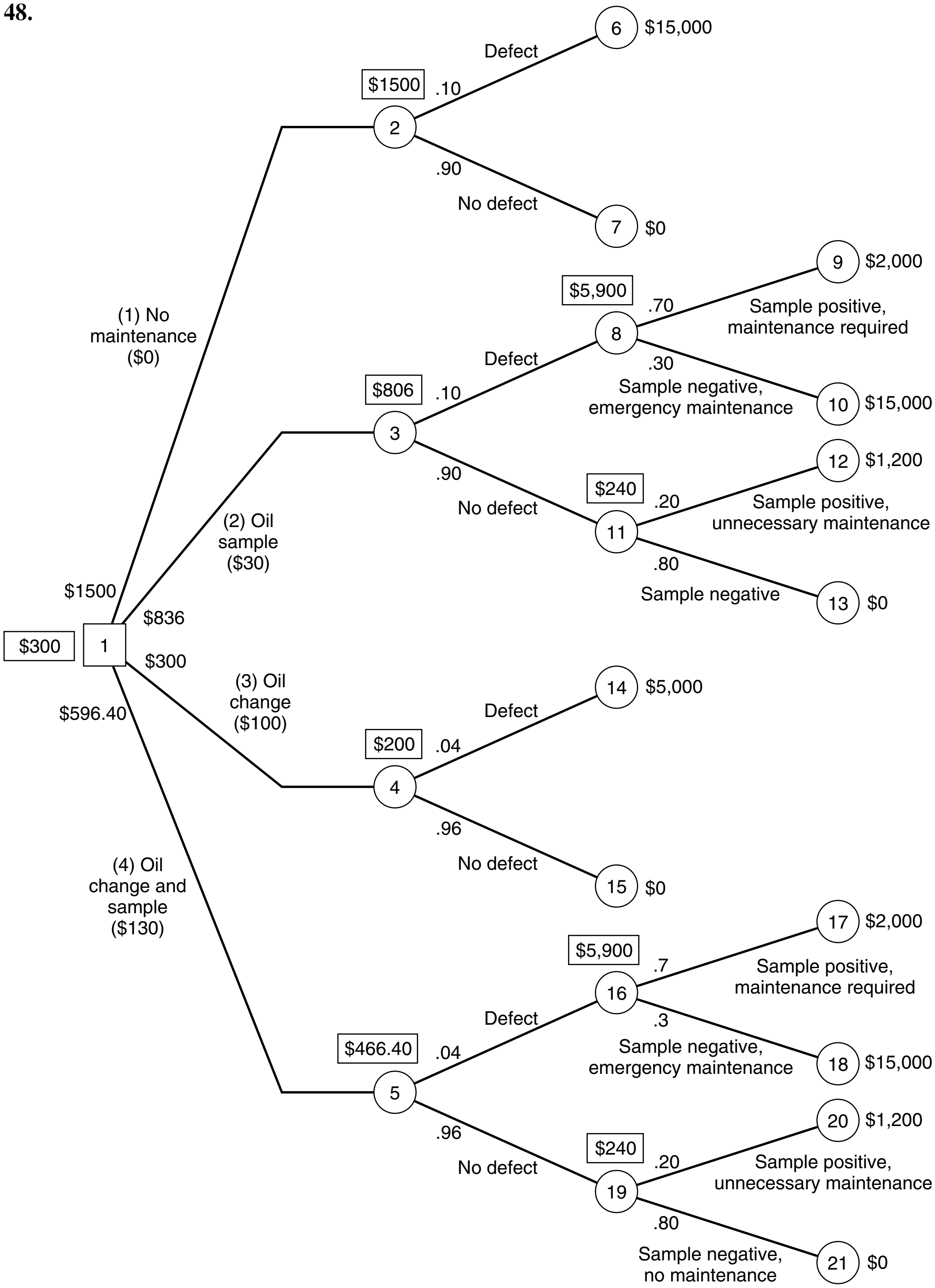
Ellie should invest in the index fund with an expected return of $65,200.

47.



Select strategy 3

48.


$300
1
$1500
$836
$300
$596.40
(1) No
maintenance
($0)
(2) Oil
sample
($30)
(3) Oil
change
($100)
(4) Oil
change and
sample
($130)
$1500
2
.10
Defect
6
$15,000
.90
No defect
7
$0
$806
3
.10
Defect
$5,900
8
.70
Sample positive,
maintenance required
9
$2,000
.30
Sample negative,
emergency maintenance
10
$15,000
.90
No defect
$240
11
.20
Sample positive,
unnecessary maintenance
12
$1,200
.80
Sample negative
13
$0
$200
4
.04
Defect
14
$5,000
.96
No defect
15
$0
$466.40
5
.04
Defect
$5,900
16
.7
Sample positive,
maintenance required
17
$2,000
.3
Sample negative,
emergency maintenance
18
$15,000
.96
No defect
$240
19
.20
Sample positive,
unnecessary maintenance
20
$1,200
.80
Sample negative,
no maintenance
21
$0