CHAPTER 1 – INTRODUCTION TO OPERATIONS AND SUPPLY CHAIN MANAGEMENT

ANSWERS TO QUESTIONS, PROBLEMS, AND CASE PROBLEMS

Answers to Questions

1-1. The operations function involves organizing work, selecting processes, arranging layouts, locating facilities, designing jobs, measuring performance, controlling quality, scheduling work, managing inventory, and planning production. Operations interacts with marketing in product development, forecasting, production planning, and customer service. Operations and finance interact in capital budgeting, cost analysis, production and inventory planning, and expansion and technology plans. Operations and human resources work together recruiting, training and evaluating workers, designing jobs and working with unions. IT and operations work together daily on e-commerce, enterprise resource planning and supply chain management systems.

1-2. a. Operations at a bank involves transferring funds, processing funds, providing cheques, cashing cheques, preparing monthly statements, reconciling statements, approving loans, loaning money, keeping track of loan payments, approving credit cards, and more.

b. Operations at a retail store involves purchasing goods, stocking goods, selling goods, keeping track of inventory, scheduling workers, laying out the store, locating the store, forecasting demand, and more.

c. Operations at a hospital involves preparing the rooms, scheduling doctors, nurses and other workers, processing paperwork, ordering supplies, caring for patients, maintaining the facility, laying out the facility, ensuring quality and more.

d. Operations at a cable TV company involves taking orders, installing equipment, maintaining equipment, keeping the shows on the air, scheduling work, processing statements and payments, and more.

1-3. Inventions during the *industrial revolution* brought workers together under one roof in a factory setting where division of labour and interchangeable parts encouraged the formation of separate worker and management jobs. Ideas from the *scientific management* era made work more efficient. *Human relations* theorists emphasized the importance of the human element in operations management. *The management science era* saw many advances in quantitative techniques and their application. The *quality revolution* focused management on meeting customer expectations and emphasized quality over quantity. The *Internet* brought numerous opportunities to do work faster and better. It also opened doors to new markets worldwide. Today's successful companies compete worldwide for both market access and production resources.

1-4. *Productivity* is the ratio of output to input. Output can be expressed as units produced, customers served, calls answered, or sales dollars. Inputs include labour, materials, capital, or square footage. *Single-factor productivity* measures the ratio of an output to a single input. *Multi-factor productivity* relates output to a combination of inputs that are all

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expressed in the same units (e.g., labour cost + materials cost). *Total factor productivity* computes the total quantity of goods and serviced produced with all of the inputs used to produced them.

1-5. Student answers will vary. The information can be accessed directly from the Internet.

1-6. Student answers will vary.

1-7. Students can begin this assignment by accessing Fortune's homepage and referring to the Fortune 500 or ***Global 500*** by industry. The leaders in each industry are listed and there is usually some discussion of industry concerns. Individual data on companies can be found at Hoover's website (*www.hoovers.com*).

1-8. Student answers will vary.

1-9. Student answers will vary.

1-10. Student answers will vary. The information can be accessed directly from the Internet.

1-11. The WTO is an international organization that works to establish and enforce rules of trade between nations. WTO agreements are ratified by the governing bodies of the nations involved. WTO's dispute settlement process interprets agreements and rules on violations, thereby avoiding political or military conflict. The group promotes free trade and more recently, has helped developing nations enter the trade arena on more equitable grounds. Currently, there are 164 member nations. Membership is achieved by meeting certain environmental, human rights, and trade criteria, agreeing to abide by the rules of the organization, and being approved by two-thirds of the existing membership. See *www.wto.org*

1-12. Student answers will vary. Access *www.worldbusinessculture.com*

1-13. Student answers will vary. Access *www.transparency.org*

1-14. Student answers will vary. Access *http://laws-lois.justice.gc.ca/eng/acts/C-45.2/* for basic information.

1-15. Students will find a variety of answers for this question. In general, it is easy to find mission or vision statements, but more difficult to find evidence of the mission or vision being applied.

1-16. Strategy formulation consists of four basic steps: (1) *defining a primary task*—what is the purpose of the firm? What the firm is in the business of doing? (2) *assessing core competencies*—what does a firm do better than anyone else? (3) determining *order winners and order qualifiers*—what wins orders in the marketplace? What qualifies a product or service to be considered for purchase? (4) *positioning the firm*—what one or two important things should the firm choose to concentrate on? How should the firm compete in the

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marketplace?
Student answers will vary. Most start-ups try too much too soon. It's difficult to stick with what you do best.

1-17. *Core competencies* are the essential capabilities that create a firm's sustainable competitive advantage. They have usually been built up over time and cannot be easily imitated. For example, First National Bank, one of our local banks, is known as a risk taker. Its core competence is its ability to size up the potential of investment opportunities. Through its familiarity with local businesses and its experience in loan making, the bank has developed the ability to predict which loans are worth taking extra risks.
Walmart, a successful retail store, is known for having a wide assortment of items at competitive prices. The store carries clothing, fresh food, toys, books, and sports equipment, and offers services such as photo printing and pharmacy. They specialize in low prices by managing their supply chain operations and inventory carefully.
Toyota emphasizes superior quality at a price below its competitors with its Lexus line of automobiles. To establish a special reputation for quality over the lifetime of the car, the company set up separate sales and service facilities. When it is time for servicing, Lexus owners can have their vehicle picked up and delivered to their home or place of business. The car returns the same day, washed and vacuumed, often with a gift certificate inside for a night on the town complements of the dealer.

1-18. While the answers to this question vary considerably, most students feel competent in the technical areas of their major, but uncomfortable with their communication skills (both oral and written) and their ability to make decisions. This opens the way for more project-oriented assignments from the instructor. The question also helps students prepare for the inevitable interview question—what are your strengths and weaknesses?

1-19. *Order qualifiers* are characteristics of a product or service that qualify it to be considered for purchase by a customer. An *order winner* is the characteristic of a product or service that wins orders in the marketplace—the final factor in the purchasing decision.
When buying a simple product like coffee, students might use order qualifiers to narrow down options (e.g. eliminating choices that are too expensive), the using an order winner to make the decision (e.g. choosing the option that is closest, or with the shortest line).

1-20. a. Most companies approach quality in a defensive or reactive mode; quality is confined to minimizing defect rates or conforming to design specifications. To *compete on quality*, companies must view quality as an opportunity to please the customer, not just as a way to avoid problems or to reduce rework costs. The manufacturer of Rolex watches competes on quality.
b. Companies that *compete on cost* relentlessly pursue the elimination of all waste. The entire cost structure is examined for reduction potential, not just direct labour costs. High volume production and automation may or may not provide the most cost-effective alternative. Wal-Mart competes on cost.
c. *Flexibility* includes the ability to produce a wide variety of products, to introduce new products and to modify existing products quickly, and, in general, to respond to customer needs. Steelcase Canada competes on flexibility.

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d. *Competing on speed* requires a new type of organization characterized by fast moves, fast adaptations, and tight linkages. Citicorp competes on speed.
e. *Competing on innovation* requires taking risks and challenging the status quo. Companies must also be prepared accept failure as part of the learning process. Google, Apple, and 3M compete on innovation, as does SpaceX.
f. *Competing on service* requires closeness to the customer, availability of resources, attention to detail, and flexible operations. Ritz-Carlton competes on service.

1-21. Operations can play two important roles in corporate strategy: (1) it can provide *support* for the strategy of a firm (help with order qualifiers), and (2) it can serve as a firm's *distinctive competence* (win orders).

1-22. Strategic decisions in operations and supply chain management involve products and services, processes and technology, capacity and facilities, human resources, quality, sourcing, and operating systems.

1-23. *Policy deployment* tries to focus everyone in an organization on common goals and priorities by translating corporate strategy into measurable objectives down through the various functions and levels of the organization. As a result, everyone in the organization should understand the strategic plan, be able to derive several goals from the plan, and determine how each goal ties into their own daily activities.

1-24. The balanced scorecard examines a firm's performance in four critical areas – its finances, customers, processes, and capacity for learning and growing. Although operational excellence is important in all four areas, the tools in operations are most closely associated with process.

1-25. Student answers will vary.

1-26. Student answers will vary. The balanced scorecard worksheet in Table 1.3 is helpful. *Finances* might refer to future income, *customers* to potential employers who are interested in both grades and experience, *processes* to how students will raise their grades and gain experience, and *learning and growing* to developing skills in several areas.

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Answers to Problems

(Answers may vary due to rounding)

1-1. The Kingston store is the most productive.

Store	Hamilton	Kingston	London	Waterloo
Sales volume	$40,000	$12,000	$60,000	$25,000
Labour hours	250	60	500	200
Productivity	$160	$200	$120	$125

1-2. a. London is the most productive ($8.33).
b. Based on productivity, the Kingston store should be closed. Other factors to consider include total revenue, potential for growth, and options for reducing costs.

	Hamilton	Kingston	London	Waterloo
Sales volume	$40,000	$12,000	$60,000	$25,000
Labour hours	250	60	500	200
Labour cost/hr	$12.75	$12.50	$12.00	$11.50
Rent	$1,800	$2,000	$1,200	$800
Productivity	$8.02	$4.36	$8.33	$8.07

1-3. By number, Jim was more productive last year. By weight, Jim was more productive this year.

	Last yr	This yr
Hours fishing	4	6
Bass caught	12	15
Average weight	20	25
Bass/hr	3	2.5
Avg Weight/hr	60	62.5

1-4. Productivity could be measured by total account dollars per hour worked, new account dollars per hour worked, or existing account dollars per hour worked. Boisvert is the most productive based on total output. Albert and Duong have the most new accounts, and thus the greater potential returns in the future. However, Duong cannot work many more hours a week and Boisvert is only working half time. Boisvert has the potential to sell more if he works more hours.

Agents	Albert	Boisvert	Cressey	Duong
New accounts	$100,000	$40,000	$80,000	$200,000
Existing accounts	$40,000	$40,000	$150,000	$100,000
Labour hours	40	20	60	80
Total $/hr	$3,500.00	**$4,000.00**	$3,833.33	$3,750.00
$ New accts/hr	**$2,500.00**	$2,000.00	$1,333.33	**$2,500.00**
$ Existing accts/hr	$1,000.00	$2,000.00	**$2,500.00**	$1,250.00

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1-5. Japan is the most productive.

	Labour Hours	Units of Output	Productivity
Canada	79.2	87.1	1.10
Germany	89.6	103.6	1.16
Japan	86.3	117.6	**1.36**

1-6. Omar should probably close the plant in Guadalajara because its multifactor productivity is the lowest, its labour productivity is the second lowest, and its output is the least of the four plants.

Units (in 000's)	Montreal	Frankfurt	Guadalajara	Bejiing
Finished goods	10,000	12,000	5,000	8,000
Work-in-process	1,000	2,200	3,000	6,000

Costs (in 000's)				
Labour costs	$3,500	$4,200	$2,500	$800
Material costs	$3,500	$3,000	$2,000	$2,500
Energy costs	$1,000	$1,500	$1,200	$800
Transportation costs	$250	$2,500	$2,000	$5,000
Overhead costs	$1,200	$3,000	$2,500	$500

Labour productivity	3.14	3.38	3.20	17.50
Total productivity	1.16	1.00	0.78	1.46

1-7. Hill is the most productive in terms of rushing yards and touchdowns per carry. However, **Peressini** has highest number of rushing yards and touchdowns. Using "carries" as the input variable skews the results. Productivity is not always the best measure of performance.

Candidates	Hill	Lévesque	Peressini
Rushing yards	2,110	3,623	6,925
# Carries	105	875	1,186
# Touchdowns	15	20	70

Yards/carry	20.10	4.14	5.84
Touchdowns/carry	0.14	0.02	0.06

1-8. Productivity decreases from week to week.

Installation	1	2	3
Square Feet	11,025	12,915	22,500
# workers	4	3	5
# hours	3	5	6

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Square Feet/hr	918.75	861	750

1-9.

Centre	**1**	**2**	**3**	**3c.**
Pieces processed	1,000	2,000	3,000	5,000
Workers/hr	10	5	2	2
Hourly wage rate	$20.50	$25	$27	$27
Overhead/hr	$10	$25	$50	$80
Multifactor productivity	4.65	13.33	**28.85**	**37.31**

a. Work center # 3 is the most productive.
b. With a 10% raise in center 1, productivity goes down to 4.25 pieces per dollar spent.
c. With new equipment in center 3, productivity goes up to 37 pieces. Install the new equipment.

1-10. Material productivity is stable over the 4 weeks. Labour productivity increases in week 2 and decreases in weeks 3 and 4.

Week	**1**	**2**	**3**	**4**
Units of output	2,000	4,000	5,000	7,000
# workers	4	4	5	6
Hours per week	40	48	56	70
Labour cost per hour	$20	$20	$20	$20
Material (kgs.)	128	256	324	450
Material cost per kg	$8	$8	$8	$8

Labour productivity [units/hr]	12.50	20.83	17.86	16.67
Labour productivity [units/$]	0.63	1.04	0.89	0.83
Material productivity [units/kg]	15.63	15.63	15.43	15.56
Material productivity [units/$]	1.95	1.95	1.93	1.94
Multifactor productivity [units/$]	0.47	0.68	0.61	0.58

1-11. Johan is the most productive.

	Jake	**Jasbir**	**Jennifer**	**Johan**
# ads sold	100	50	200	35
# hours spent	40	15	85	10
Output/hr	2.50	3.33	2.35	**3.50**

1-12. Choose Cold Case.

	Alaskan Seal	**Brr Frost**	**Cold Case**	**Deep Freeze**
Purchase cost	$3,270	$4,000	$4,452	$5,450
Daily energy consumption	3.61	3.88	6.68	29.07

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(kwh)				
Cost per kwh	$0.10	$0.10	$0.10	$0.10
Daily energy cost	$0.36	$0.39	$0.67	$2.91
Daily purchase cost	$2.99	$3.65	$4.07	$4.98
Total cost	$3.35	$4.04	$4.73	$7.88
Volume (cu ft)	25	35	49	72
Productivity (cu ft/$)	7.47	8.66	**10.35**	9.14
Cost/cu ft	$0.13	$0.12	$0.10	$0.11

1-13. Sweet Tooth should switch to the new process.

	Current process	New process
Chocolate powder(kg)	100	200
Cocoa beans(kg)	1000	1800
Hours of processing	10	15
Cost of processing	$25	$25
Cost of cocoa beans	$6.80	$6.80
Labour productivity (kg/$)	0.4	0.53
Multi factor productivity (kg/$)	0.014	0.016

1-14.

Pairs of jeans	60
Workers	3
Machines	3
Hours/day	8
Labour hours / day	24
Raw material cost/ pair	$10
Labour cost / hour	$20
Energy cost/ hour of machine time	$1
Machine cost/ hour	$10
Total energy cost	$24
Total labour cost	$480
Total machine cost	$240
Total material cost	$600
Total cost of producing 60 pairs of jeans	$1344
Labour productivity (jeans/hr)	2.5
Unit cost ($/jeans)	22.4
Multi-factor productivity	0.044643

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The multi-factor productivity here shows the number of jeans that can be produced for every $1 input through labour, raw material, machine, and energy combined.

1-15.

	productivity per hour	hourly compensation cost ($)	productivity (output per dollar)
Turkey	42	6.09	6.896552
Mexico	21	3.91	5.370844
India	9	1.69	5.325444
Taiwan	52	9.82	5.295316
Philippines	10	2.06	4.854369
Hungary	34	8.6	3.953488
China	15	4.11	3.649635
Singapore	66	26.75	2.46729
Brazil	18	7.98	2.255639
Norway	96	48.62	1.974496
United Kingdom	54	28.41	1.900739
Unites States	72	39.03	1.844735
Canada	55	30.08	1.828457
Japan	47	26.46	1.776266
France	67	37.72	1.776246
Italy	53	32.49	1.631271
Germany	70	43.18	1.621121
South Korea	37	22.98	1.610096
Sweden	65	41.68	1.559501
Switzerland	65	60.36	1.076872

Turkey, Mexico, India, Taiwan, and Phillipines are the most productive, while Italy, Germany, South Korea, Sweden, and Switzerland are the least productive.

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Answers to Case Problem 1.1: Visualize This

1. It is difficult to follow the four steps of strategy formulation for this case. Students will be able to easily identify VT's core competency but will struggle with its primary task, and without a product, it's impossible to determine an order winner and order qualifiers. "Developing the next generation of visualization tools" is probably not a marketable task. Students will come up with a variety of ideas from their Internet search.

2. Student answers will vary depending on how the primary task is derived in question 1.

3. That's the crux of the problem for this case. Isaac needs to find a way to keep his business going to obtain the capital to pursue his dream. Great for class discussion.

4. (1) and (3) are more in keeping with VT's earlier projects but require more hardware and do not promise future business. (2) is the most time-consuming, least challenging, but most sustainable. (4) and (5) are the most lucrative but do not advance VT's knowledge of the field.

5. The selection of projects should reinforce the strategy determined by the student. This case is based on an actual situation. The company chose projects (1) and (3). The museum job consumed so much time and resources that the company had to turn down the bank training job. Without a "product" and no immediate repeat business, the company folded and the owner went back to academe. A student took on project (5) and became quite successful.

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Answers to Case Problem 1.2: Whither an MBA at Brandon?

1. The board of Regents should look at the proposal carefully and identify first what they are trying to achieve with this new program. If the program fits within their mission, and if they have the resources to pursue it, they need to assess the likelihood of their success or failure. It doesn't appear that the board has sufficient information or insight to make the decision. A lot of questions remain. The focus of the program (i.e., interdisciplinary, problem solving, etc.) doesn't seem like much of a focus at all. The desire to "try anything" to get more students is troublesome. A new program that Brandon can't support would damage their reputation. Brandon needs to gather more information before a decision can be made.

2. Brandon should go through the process of identifying its primary task. This would include the type of students it wishes to serve and their future role in society (i.e., community, regional, provincial, national, global). A clear assessment of Brandon's core competence is also needed. What special resources does the university have? What is it best known for? How does it compare to other institutions of similar size and mission?

   After those issues have been settled, the university needs to find out what its customers (i.e., students) look for when deciding where to go to school. What are some basic requirements that Brandon should meet (i.e., order qualifiers)? What factor prompts the final determination of which school to attend (i.e., order winner)? If, as is hinted in the case, the ability to find employment upon graduation is important to prospective students, then the university should gather information from potential employers about their needs. It may very well be that an MBA program is needed in the area, but this needs to be determined from data. Only after the determination has been made, that the area needs another MBA program, should Brandon explore the possibility of providing it. If the university concludes that it has the skills and resources necessary to pursue the task, then it should try to position itself properly in the market and find a special niche for its particular MBA program.

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Answers to Case Problem 1.3: Weighing Options at the Weight Club

A Balanced Scorecard for the Weight Club:

Dimension		Objectives	Key Performance Indicator	Goal
Finances	Revenue	Generate revenue for first-class facility	% increase in revenue	30%
	Growth	Attract new customers	% increase in customers	25%
Customers	Quality	Meet or exceed customer needs	% customers satisfied	100%
	Retention	Build sustainable customer base	% membership renewals	75%
Processes	Fitness	Increase participation in exercise classes	# exercise classes/week	12
		Increase use of personal trainers	# client hours/week	100
	Client services	Enhance client experience	% participation in customer orientation	75%
			# massage appointments/week	200
		Facilitate use of services	Time required for check-in	1 min
			Hours of child care/week	90%
	Equipment maintenance	Maintain equipment in top working condition	% fully operational	95%
			% on regular maintenance schedule	60%
Learning & Growing	Program development	Develop professional staff	% new classes	25
			# innovative suggestions	30
	Facility development	Provide first-class facilities and equipment	% equipment new or updated	100%
			Months until facility expanded/ renovated	6
	Organizational development	Develop management and administrative skills	# persons on Board of Directors	6
			# full-time managers	3

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CHAPTER 1 SUPPLEMENT
OPERATIONAL DECISION-MAKING TOOLS: DECISION ANALYSIS

ANSWERS TO PROBLEMS AND CASE PROBLEMS

Answers to Problems
(Answers may vary due to rounding)

S1-1. a. Minimin:
South Korea 15.2
China 17.6
Taiwan 14.9
Poland 13.8
Mexico $12.5 \leftarrow \text{minimum}$
Select Mexico

b. Minimax:
South Korea 21.7
China $19.0 \leftarrow \text{minimum}$
Taiwan 19.2
Poland 22.5
Mexico 25.0
Select China

c. Hurwicz $(\alpha = 0.40)$:
South Korea: $15.2(0.40) + 21.7(0.60) = 19.10$
China: $17.6(0.40) + 19.0(0.60) = 18.44$
Taiwan: $14.9(0.40) + 19.2(0.60) = 17.48 \leftarrow \text{minimum}$
Poland: $13.8(0.40) + 22.5(0.60) = 19.02$
Mexico: $12.5(0.40) + 25.0(0.60) = 20.0$
Select Taiwan

d. Equal likelihood:
South Korea: $21.7 * \frac{1}{3} + 19.1 * \frac{1}{3} + 15.2 * \frac{1}{3} = 18.67$
China: $19.0 * \frac{1}{3} + 18.5 * \frac{1}{3} + 17.6 * \frac{1}{3} = 18.37$
Taiwan: $19.2 * \frac{1}{3} + 17.1 * \frac{1}{3} + 14.9 * \frac{1}{3} = 17.07$ ← minimum
Poland: $22.5 * \frac{1}{3} + 16.8 * \frac{1}{3} + 13.8 * \frac{1}{3} = 17.7$
Mexico: $25 * \frac{1}{3} + 21.2 * \frac{1}{3} + 12.5 * \frac{1}{3} = 19.57$
Select Taiwan

S1-2. $\text{EV}(\text{South Korea}) = 21.7(.30) + 19.1(.40) + 15.2(.30) = 18.71$

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$\text{EV}(\text{China}) = 19.0(.30) + 18.5(.40) + 17.6(.30) = 18.38$

$\text{EV}(\text{Taiwan}) = 19.2(.30) + 17.1(.40) + 14.9(.30) = 17.07 \leftarrow \text{minimum}$

$\text{EV}(\text{Poland}) = 22.5(.30) + 16.8(.40) + 13.8(.30) = 17.61$

$\text{EV}(\text{Mexico}) = 25.0(.30) + 21.2(.40) + 12.5(.30) = 19.73$

Select Taiwan

Expected value given perfect $\text{information} = 19(.30) + 16.8(.40) + 12.5(.30) = 16.17$

$\text{EVPI} = 16.17 - 17.07 = \$ - 0.9 \text{ million}$

The EVPI is the maximum amount the *cost* of the facility could be reduced (.9 million) if perfect information can be obtained.

S1-3. a. Maximax criteria:
Office building $4.5 \leftarrow \text{maximum}$
Parking lot 2.4
Warehouse 1.7
Shopping mall 3.6
Condominiums 3.2
Select office building

b. Maximin criteria:
Office building 0.5
Parking lot $1.5 \leftarrow \text{maximum}$
Warehouse 1.0
Shopping mall 0.7
Condominiums 0.6
Select parking lot

c. Equal likelihood:
Office building: $0.5 * \frac{1}{3} + 1.7 * \frac{1}{3} + 4.5 * \frac{1}{3} = 2.23$ 🡐maximum
Parking lot: $1.5 * \frac{1}{3} + 1.9 * \frac{1}{3} + 2.4 * \frac{1}{3} = 1.93$
Warehouse: $1.7 * \frac{1}{3} + 1.4 * \frac{1}{3} + 1.0 * \frac{1}{3} = 1.37$
Shopping mall: $0.7 * \frac{1}{3} + 2.4 * \frac{1}{3} + 3.6 * \frac{1}{3} = 2.23$ 🡐maximum
Condominiums: $3.2 * \frac{1}{3} + 1.5 * \frac{1}{3} + 0.6 * \frac{1}{3} = 1.77$
Select office building or shopping mall

d. Hurwicz criteria $(\alpha = 0.3)$:
Office building: $4.5(0.3) + 0.5(0.7) = 1.70$
Parking lot: $2.4(0.3) + 1.5(0.7) = 1.77 \leftarrow \text{maximum}$
Warehouse: $1.7(0.3) + 1.0(0.7) = 1.21$
Shopping mall: $3.6(0.3) + 0.7(0.7) = 1.57$

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Condominiums: $3.2(0.3)+0.6(0.7)=1.38$

Select parking lot

S1-4. a. $\text{EV}(\text{Office building}) = .5(.50)+1.7(.40)+4.5(.10)=1.38$

$\text{EV}(\text{Parking lot}) = 1.5(.50)+1.9(.40)+2.4(.10)=1.75$

$\text{EV}(\text{Warehouse}) = 1.7(.50)+1.4(.40)+1.0(.10)=1.51$

$\text{EV}(\text{Shopping mall}) = 0.7(.50)+2.4(.40)+3.6(.10)=1.67$

EV (Condominiums)=$3.2(.50) + 1.5(.40) + .6(.10) = 2.26$ 🡐 maximum

Select Condominium project

b. Expected Value with Perfect Info: $3.2(.50) + 2.4(.40) + 4.5(.10) = 3.01$
EVPI = Expected value given perfect information–expected value without perfect information = 3.01–2.26 = $0.75 million

S1-5. a. Maximax: Risk fund, maximax payoff = $167,000

b. Maximin: Savings bond maximin payoff = $30,000

c. Equal likelihood: Bond fund, maximum payoff = $35,000

d. Best decision, given probabilities: Bond fund, maximum payoff = $35,000

e. expected value given perfect information = 10000*(0.1*5+0.2*4+0.4*4.2+0.2*9.3+0.1*16.7) = 65100. The maximum amount she should pay to analyst = 65100 – 35000 = 30100

S1-6. a. Maximax: Pass for a gain of 20 yd

b. Maximin: Option for a loss of 1 yd

c. Equal likelihood: Option for a gain of 7 yds.

d. Plays ranked best to worst:

Play	EV
Pass	6.4
Option	5.3
Toss sweep	4.8
Off tackle	3.2
Screen	2.3
Draw	1.6

With a 60% chance of a blitz they should run the option, with an expected value of 11.5 yd. In 70% of cases (when Laurier uses Blitz or Nickel), Guelph will make the first down. If the only thing Guelph cares about is securing the first down, they could also run the Toss Sweep (also a

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70% chance of getting the first down).

S1-7. a.

Product	Expected Value
Widget	$160,000(0.2)+90,000(0.5)-50,000(0.3)=\$62,000$
Hummer	$70,000(0.2)+40,000(0.5)+20,000(0.3)=\$40,000$
Nimnot	$45,000(0.2)+35,000(0.5)+30,000(0.3)=\$35,500$

The best option is to introduce the widget.

b. EV given perfect information:
$160,000(0.2)+90,000(0.5)+30,000(0.3)=\$86,000.$
EV without perfect information: Widget at $62,000.
Value of perfect information: $\$86,000-\$62,000=\$24,000$
The company would consider this a maximum; since perfect information is rare, it would probably pay less than $24,000.

c. Maximax: Introduce widget, maximax $\text{payoff}=\$160,000$
Maximin: Introduce nimnot, maximin $\text{payoff}=\$30,000.$
Minimax regret: Maximum regret for Widget = $30,000 - (-50000) = \$80,000$ 🡐 min
Maximum regret for Hummer = $160,000 - 70000 = \$90,000$
Maximum regret for Nimnot = $160,000 - 45000 = \$115,000$
Introduce widget, Minimax $\text{regret}=\$80,000$
Equal likelihood: Introduce widget, maximum payoff = $66,667

S1-8. a. Maximax: Major physical revision, maximum payoff = $972,000

b. Maximin: Paperback, maximum payoff = $68,000

c. Equal likelihood: Major content revision, maximum payoff = $423,667

d. Hurwicz: Major content revision, maximum payoff = $273,900

S1-9.

Publication Decision	Expected Value
Paperback	$216,290
Similar revision	386,340
Major content revision	468,780
Major physical revision	405,970

Best decision = major content revision
Overall "best" decision appears to be a "major content revision"

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EVPI = (.23)(68,000) + (.46)(515,000) + (.31)(972,000) − 468,780 = \$85,080
This is the maximum amount Wiley would pay an "expert" for additional information about the future competitive market.

S1-10. a. Maximax: Singapore, maximum payoff = \$71 million

b. Maximin: Kaohsiung, maximum payoff = -\$15 million

c. Equal likelihood: Kaohsiung, maximum payoff = \$28.33 million

d. Hurwicz: Singapore, maximum payoff = \$37.8 million

e. Minimax regret: Singapore, minimum regret = \$9 million

S1-11. Expected value

Port	Expected Value
Hong Kong	\$22.99
Singapore	34.52
Shanghai	24.54
Busan	28.30
Kaohsiung	33.66

a. Best decision = Singapore

b. Singapore appears to be the best "overall" decision.

S1-12. Expected value

Lease Decision	Expected Value
1 – year	\$65,980
2 – year	103,010
3 – year	133,810
4 – year	154,300
5 – year	114,210

The 4 year lease is the best decision using EV.

S1-13. EVPI = (.17)(1,228,000) + (.34)(516,000) + (.49)(16000) − 154,300
= \$237,740
This is the maximum amount the restaurant owner would pay an energy "expert" for additional information about future energy prices.

S1-14. a. Maximax: Food court, maximum payoff = \$87,000

b. Maximin: Child care center, maximum payoff = \$17,000

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c. Hurwicz: Lockers and showers, maximum payoff = $32,250

d. Equal likelihood: Lockers and showers, maximum payoff = $35,333

S1-15.

Service Facility	Expected Value
Child care center	$30,560
Swimming pool	7,610
Lockers and showers	44,150
Food court	15,440
Spa	20,580

Best decision = Lockers and showers

S1-16. a. Payoff table using 12 kg in 5th row

	Demand (kg)					EV
	10	10.5	11	11.5	12	
Stock (kg)	0.10	0.20	0.30	0.30	0.10	
10	5.00	5.00	5.00	5.00	5.00	5.00
10.5	4.63	5.25	5.25	5.25	5.25	5.19
11	4.25	4.88	5.50	5.50	5.50	5.25
11.5	3.88	4.50	5.13	5.75	5.75	5.13
12	3.50	4.13	4.75	5.38	6.00	4.81

Payoff table using 22kg in 5th row (as written in 2nd Canadian edition of text)

	Demand (kg)					EV
	10	10.5	11	11.5	22	
Stock (kg)	0.10	0.20	0.30	0.30	0.10	
10	5.00	5.00	5.00	5.00	5.0	5.00
10.5	4.63	5.25	5.25	5.25	5.2	5.19
11	4.25	4.88	5.50	5.50	5.5	5.25
11.5	3.88	4.50	5.13	5.75	5.7	5.13
22	-4.00	-3.38	-2.75	-2.13	11.0	-1.44

Order 11 kg of apples for a profit of $5.25.

b. Maximax: Stock 22 kg for a maximax profit of $11.
(or stock 12 kg for a maximax profit of $6.00)
Maximin: Stock 10 kg for a maximin profit of $5.00.

S1-17. a. Payoff table:

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	Demand					
Stock	**25**	**26**	**27**	**28**	**29**	**30**
(boxes)	**0.10**	**0.15**	**0.30**	**0.20**	**0.15**	**0.10**
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

$\text{EV}(25) = 50(0.1) + 50(0.15) + 50(0.3) + 50(0.2) + 50(0.15) + 50(0.1) = \$50.00$

$\text{EV}(26) = 49(0.1) + 52(0.15) + 52(0.3) + 52(0.2) + 52(0.15) + 52(0.1) = \$51.70$

$\text{EV}(27) = 48(0.1) + 51(0.15) + 54(0.3) + 54(0.2) + 54(0.15) + 54(0.1) = \$52.95$

$\text{EV}(28) = 47(0.1) + 50(0.15) + 53(0.3) + 56(0.2) + 56(0.15) + 56(0.1)$
$= \$53.30$

$\text{EV}(29) = 46(0.1) + 49(0.15) + 52(0.3) + 55(0.2) + 58(0.15) + 58(0.1)$
$= \$53.05$

$\text{EV}(30) = 45(0.1) + 48(0.15) + 51(0.3) + 54(0.2) + 57(0.15) + 60(0.1)$
$= \$52.35$

Best decision: Stock 28 boxes, for a profit of \$53.30.

b. Expected value with perfect information:

EVwPI = 50(0.10)+52(0.15)+54(0.30)+56(0.20)+58(0.15)+60(0.10) = 54.9

$\text{EVPI} = \$54.90 - \$53.30 = \$1.60$

S1-18. a. Stock 25, maximum of minimum $\text{payoffs} = \$50$

b. Stock 30, maximum of maximum $\text{payoffs} = \$60$

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 $\text{regret} = \$4.$

S1-19. $\text{EV}(\text{press}) = 40,000(.4) - 8,000(.6) = \$11,200;$
$\text{EV}(\text{lathe}) = 20,000(.4) + 4,000(.6) = \$10,400;$
$\text{EV}(\text{grinder}) = 12,000(.4) + 10,000(.6) = \$10,800;$ purchase press.

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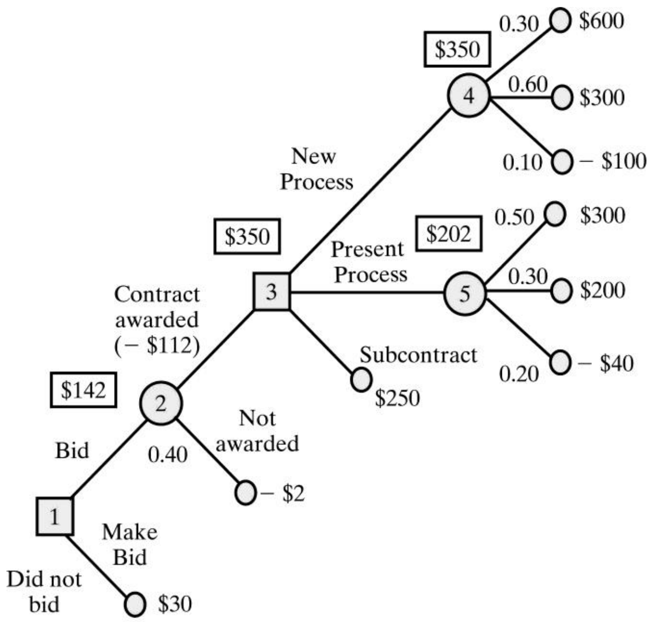
S1-20.



make bid, $ 142 mil.

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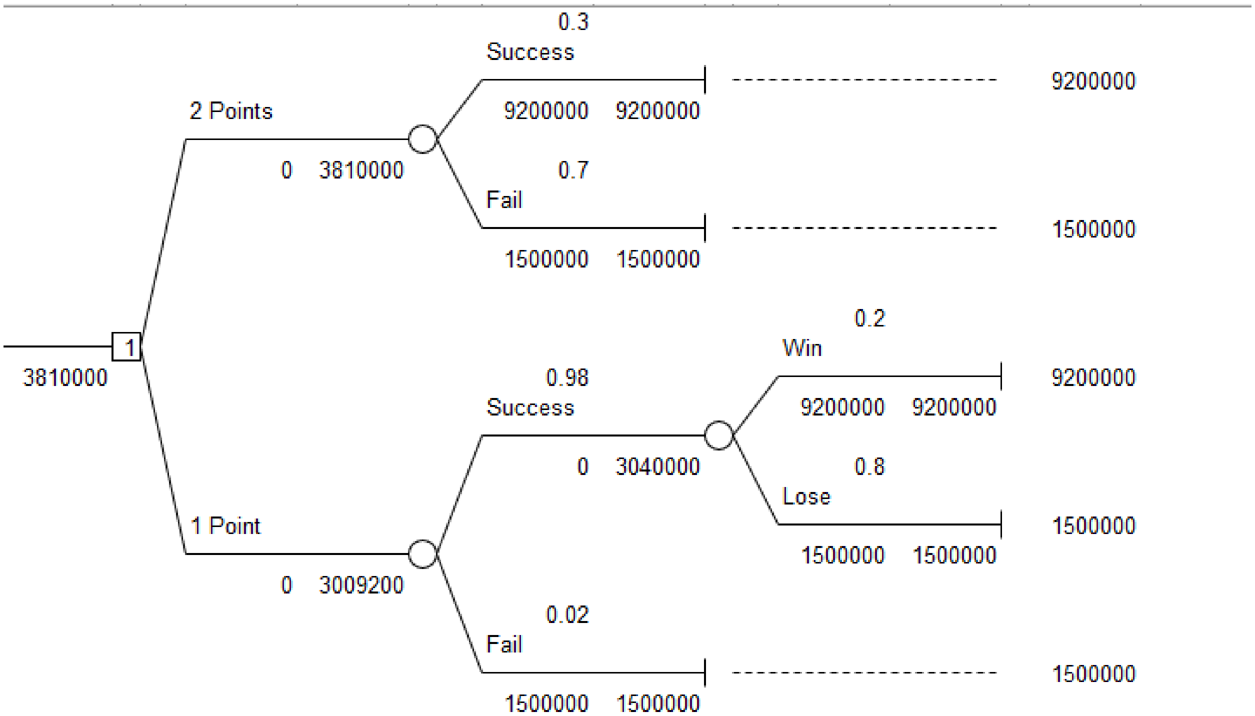
S1-21.



They should go for the two point play.

3.81M=0.02*1.5M+0.98*(9.2M*p+1.5M*(1-p))
p=0.3061

If Tech's probability of winning in overtime is 30.61%, they are indifferent between the one and two point play.

S1-22. a. Maximax = Real Estate

b. Maximin = Nursing

c. Equal Likelihood: **select Real Estate**
Graphic design = $170,000
Nursing = $187,500
Real Estate = $202,500
Medical Technology = $195,000
Culinary technology = $170,000
Computer information technology = $186,250

d. Hurwicz (alpha = 0.25): **select Nursing**
Graphic design = $141,250

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Nursing = $161,250
Real Estate = $158,750
Medical Technology = $157,500
Culinary technology = $136,250
Computer information technology = $158,750

S1-23. EV(Graphic design) = $164,250
EV(Nursing) = $183,500
EV(Real Estate) = $174,400
EV(Medical Technology) = $187,500
EV(Culinary technology) = $149,250
EV(Computer information technology) = $174,750

S1-24. a. Minimin= Philippines

b. Minimax = Mexico

c. Equal likelihood:
China= $4.3
India = $4.13
Philippines =$ 4.03 SELECT
Brazil = $4.57
Mexico = $4.87

d. minimax regret= Philippines, minimum regret = $70000

:

S1-25. a. EV(China)= $5.328
EV(India) = $ 5.375
EV(Philippines) = $5.218
EV(Brazil)= $ 5.178 SELECT
EV(Mexico) = $ 5.202

b. EVwPI= 1.7*(0.09) + 3.8*(0.27) + 5.4*(0.64) = $4.635
EVPI= 5.178-4.635= $0.543
The maximum they should pay to the analyst is $54300 (original data in $100,000s).

S1-26. a. Maximax = Hong Kong

b. Maximin = Pusan

c. Equal likelihood:

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Shanghai = $0.44 billion
Singapore = $0.37 billion
Pusan = $0.43 billion
Kaoshiung = $0.41 billion
Hong Kong = $0.47 billion

d. Hurwicz (alpha = .55):
Shanghai = $0.47 billion
Singapore = $0.41 billion
Pusan = $0.46 billion
Kaoshiung = $0.51 billion
Hong Kong = $0.77 billion

S1-27. EV(Shanghai) = $0.608 billion
EV(Singapore) = $0.606 billion
EV(Pusan) = $0.502 billion
EV(Kaoshiung) = $0.487 billion
EV(Hong Kong) = $0.724 billion

S1-28. $\text{EV}\left(\text{snow shoveler}\right) = \$30\left(.12\right) + 60\left(.19\right) + 90\left(.24\right) + 120\left(.22\right) + 150\left(.13\right) + 180\left(.08\right) + 210\left(.02\right) = \$101.10$

The cost of the snow blower ($575) is much more than the annual cost of the snow shovelling service, thus on the basis of one year the snow blower should not be purchased. However, the snow blower could be used for an extended period of time such that after approximately 6 years the cost of the snow blower would be recouped. Thus, the decision hinges on whether or not the decision maker thinks 6 years is too long to wait to recoup the cost of the snow blower.

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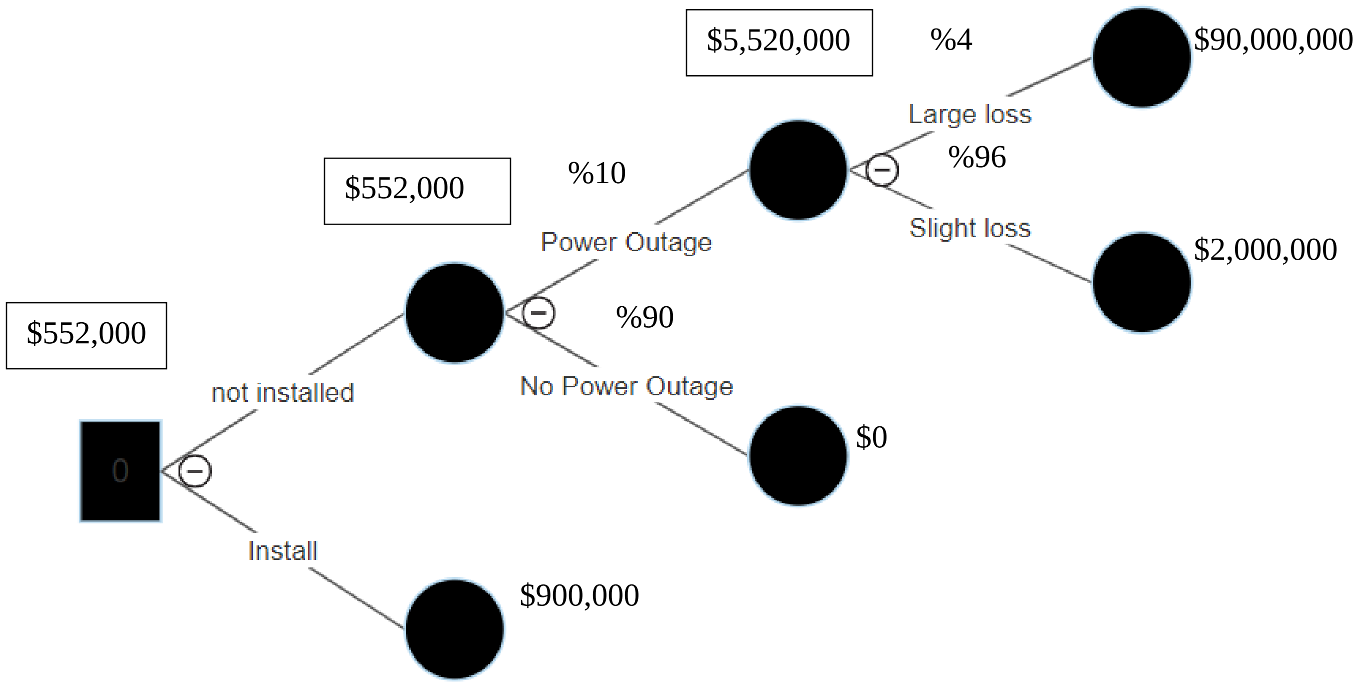
S1-29.



Since cost of installation ($900,000) is greater than expected value of not installing ($552,000), do not install an emergency power generator

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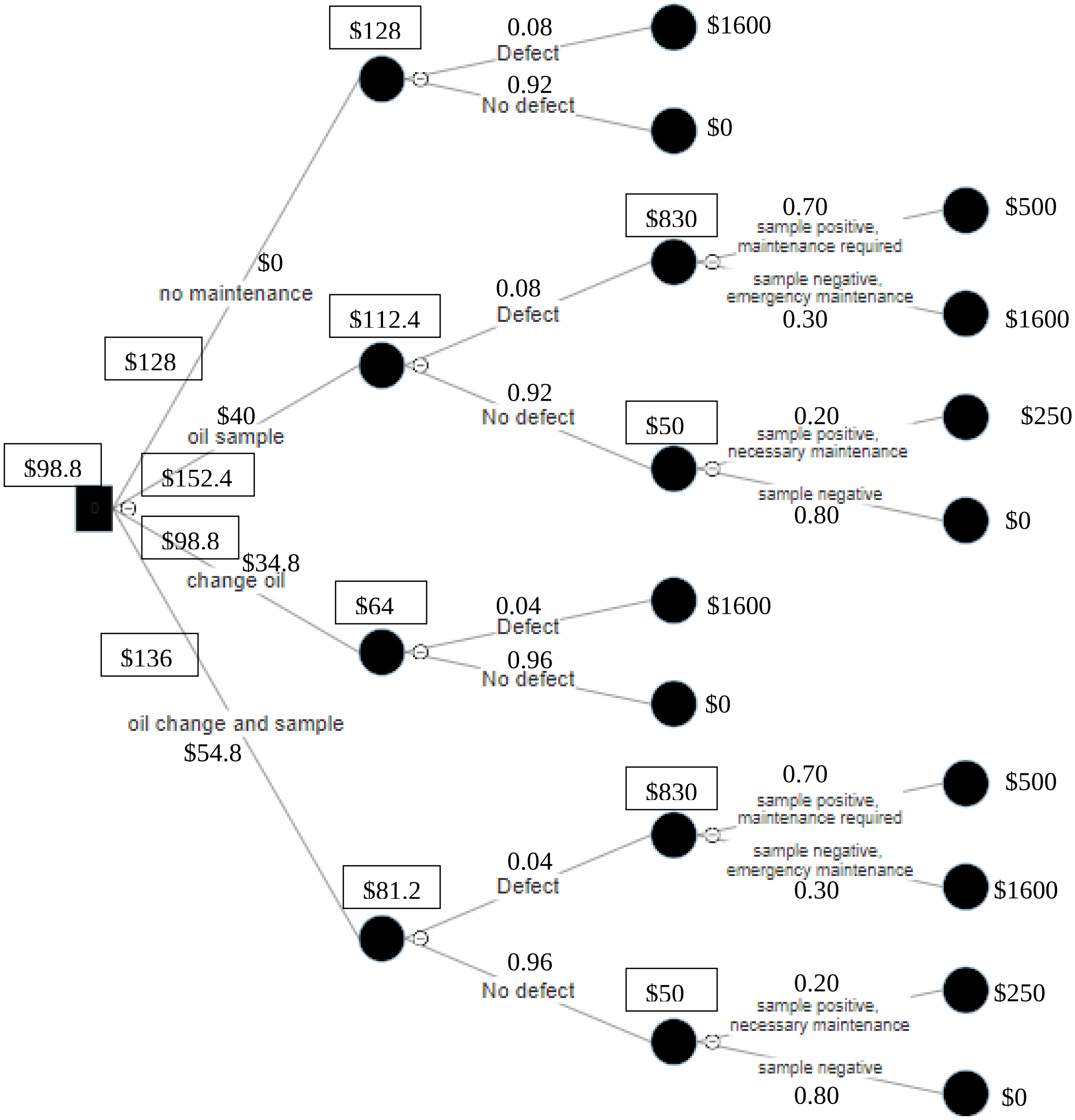
S1-30.



Select strategy 3; Change oil regularly; EV = $98.80

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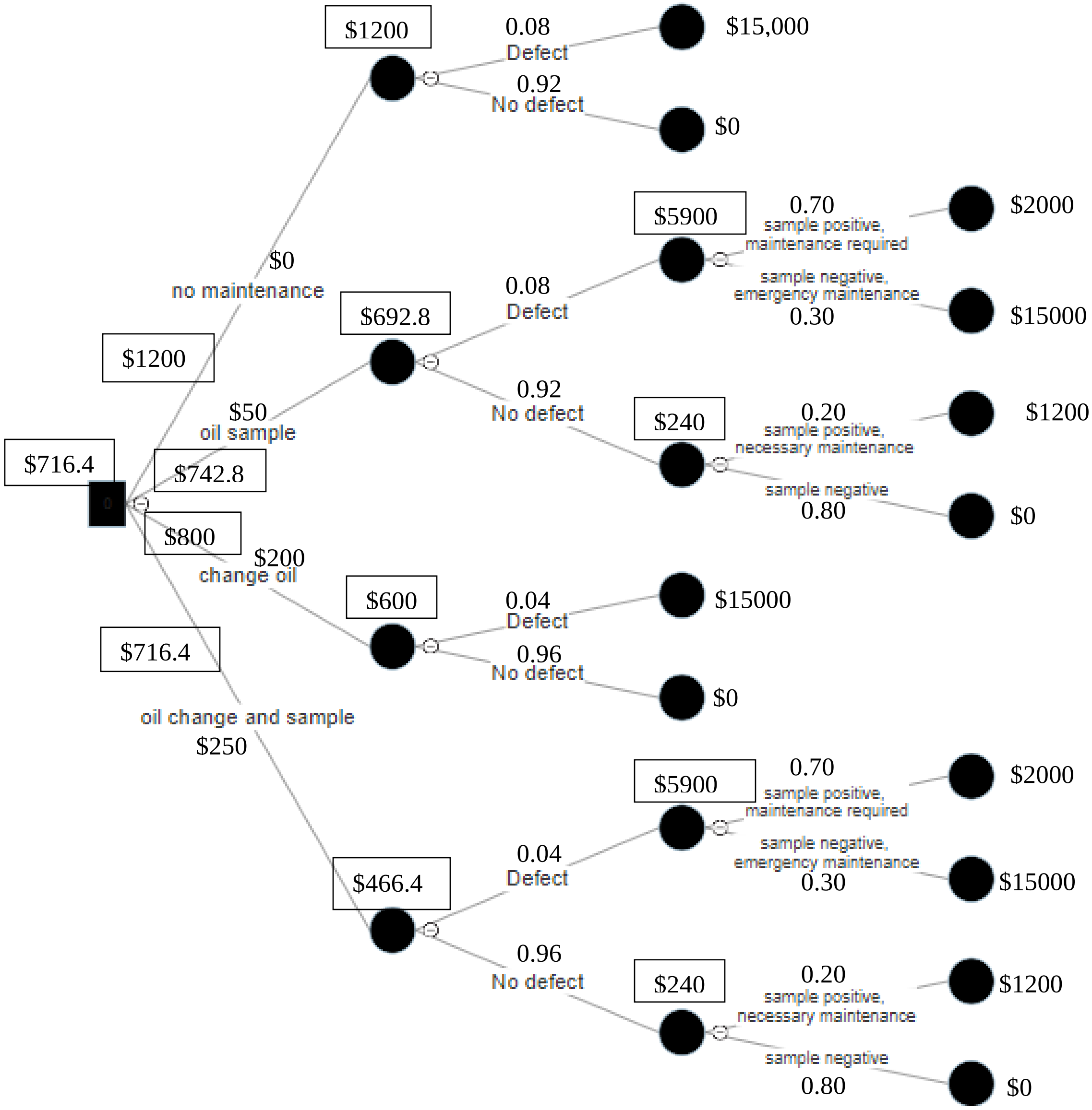
S1-31.



Select Strategy 4; Change oil and sample; EV = $716.40

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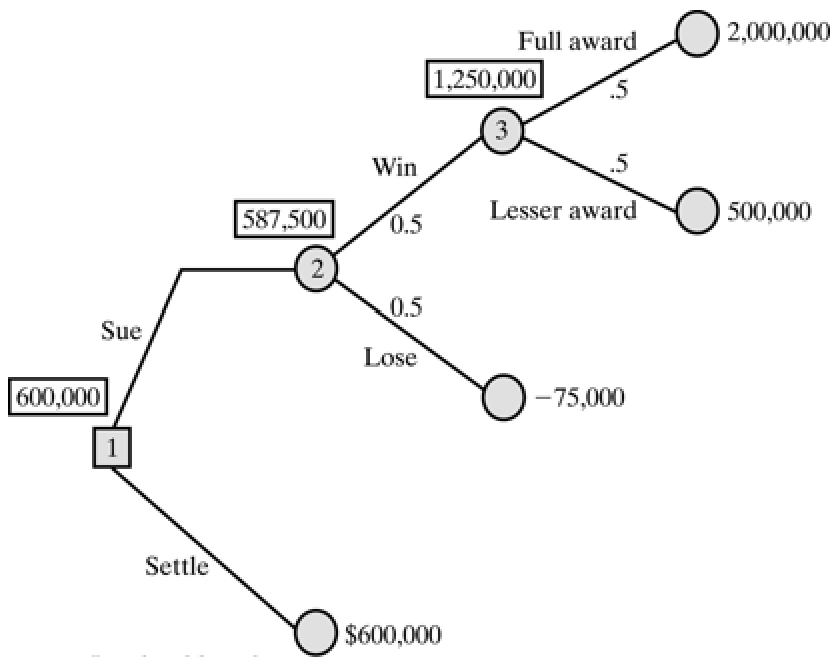
S1-32.



Mary should settle

S1-33. The following table includes the medical costs for all the final nodes in the decision tree (including all monthly costs and out of pocket expenses):

Expense	Plan 1	Plan 2	Plan 3
100	484	160	318
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

$E(1) = 954$

$E(2) = 976.5$

$E(3) = 810$

Select plan 3

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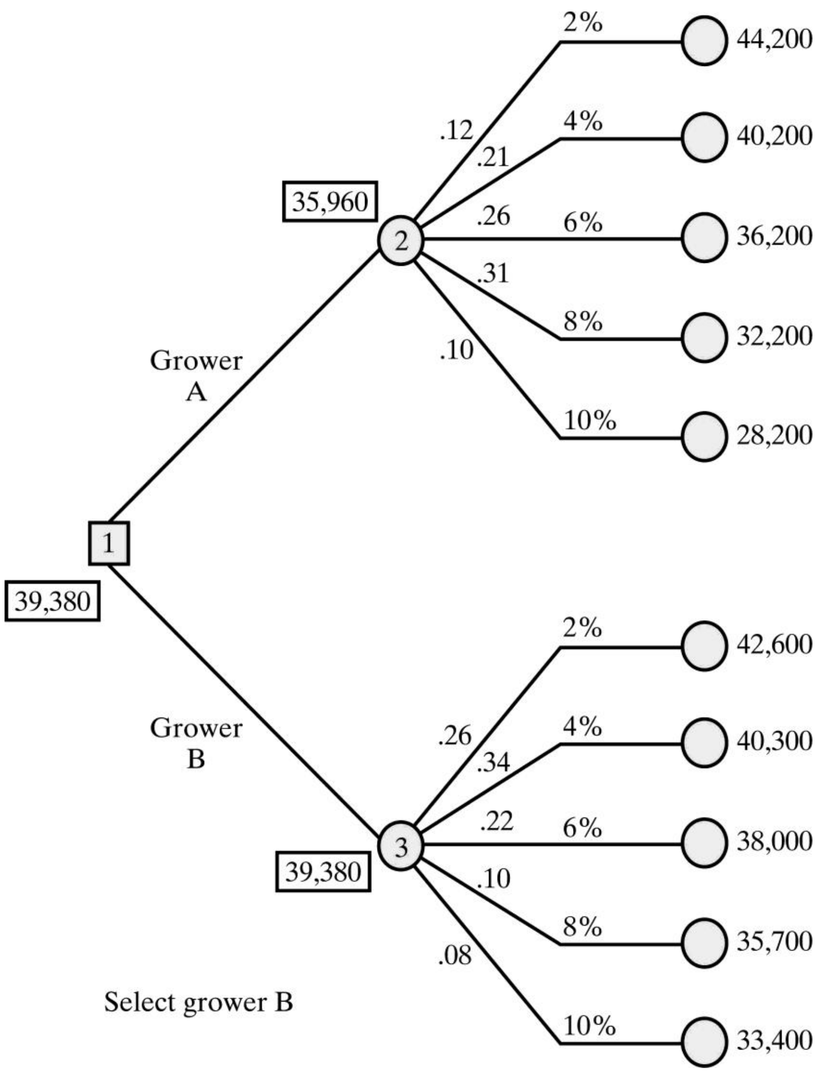
S1-34.



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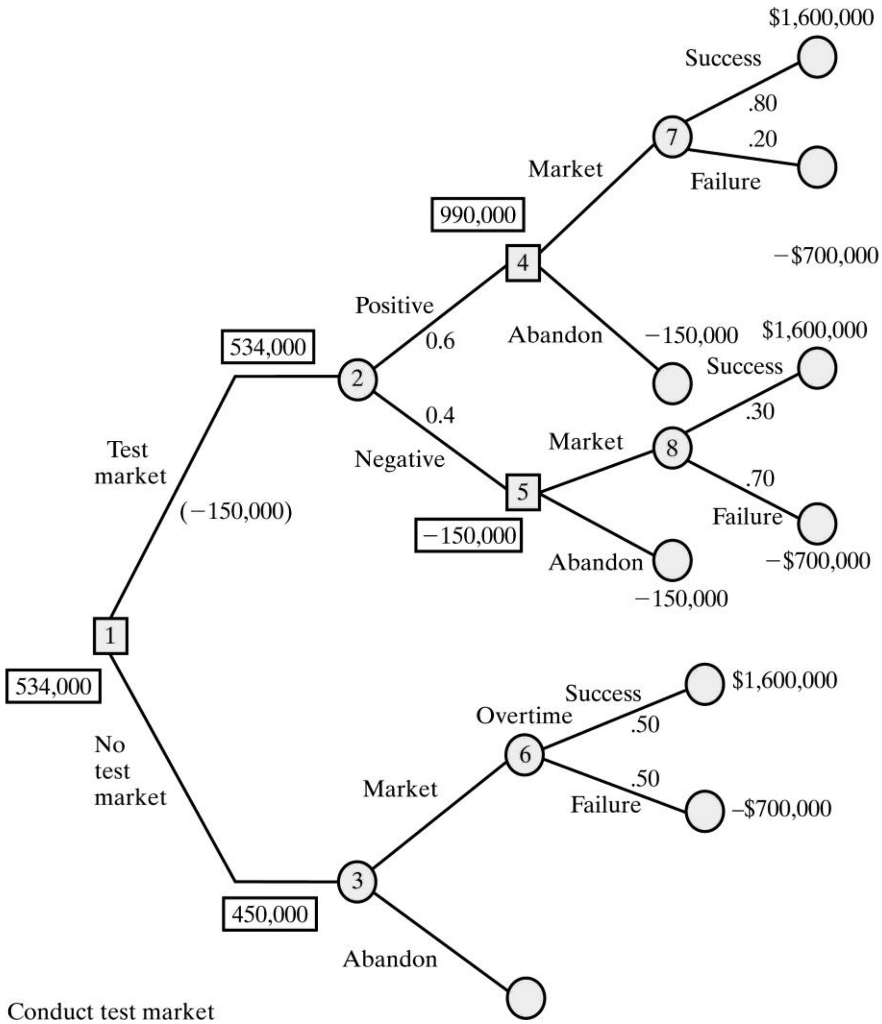
S1-35.



Conduct test market
If result is positive, then market.
If result is negative, then abandon.

S1-36.

a. Minimin = Thailand
b. Minimax = India
c. Equal likelihood:
   China= $13000000
   India = $9000000 SELECT
   Thailand = $11000000
   Philippines = $10000000
d. Philippines with minimum regret $2,000,000

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S1-37

EV(China)= $10910000
EV(India) = $7210000 SELECT
EV(Thailand) = $9770000
EV(Philippines) = $7540000

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Answers to Case Problem S1.1: Whither an MBA at Brandon?

a. Maximax: IT, maximum payoff = $517,000

b. Maximin: Health Administration, maximum payoff = –$75,000

c. Equal likelihood: Nursing, maximum payoff = $114,500

d. Hurwicz: Nursing, maximum payoff = $86,000

e. They do not have sufficient insight into the probability of the future success of the programs to indicate either optimism or pessimism; or for "political" reasons they feel it is imprudent to express a "preference." Hurwicz with alpha = 0.5 ends up selecting the choice that best balances a good best case against a not so bad worst case.

f. Best decision = Nursing

Graduate Program	Expected Value
MBA	–27,470
Computer Science	–45,000
Information Technology	10,790
Nursing	**126,760**
Health Administration	124,250

g. Nursing appears to be the best overall decision.

h. The Nursing or Health Admin programs are the best options, with Nursing having better expected results in all cases except when the program is unsuccessful. Only the most pessimistic decision makers might choose Health Admin. Since Brandon is trying to increase revenue and expand, it should be encouraged to take on this small risk and choose Nursing.

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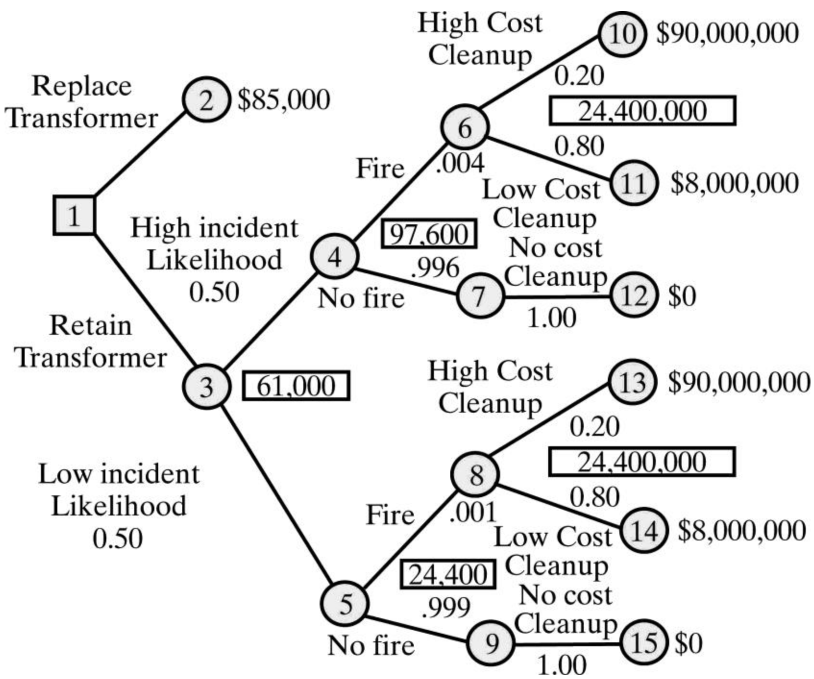
Answers to Case Problem S1.2: Transformer Replacement at Mountain Side Electric Company

The decision tree solution for this problem is shown below. The decision should be to retain the existing transformer; the cost of replacement ($85,000) is greater than the cost of retention ($61,000).



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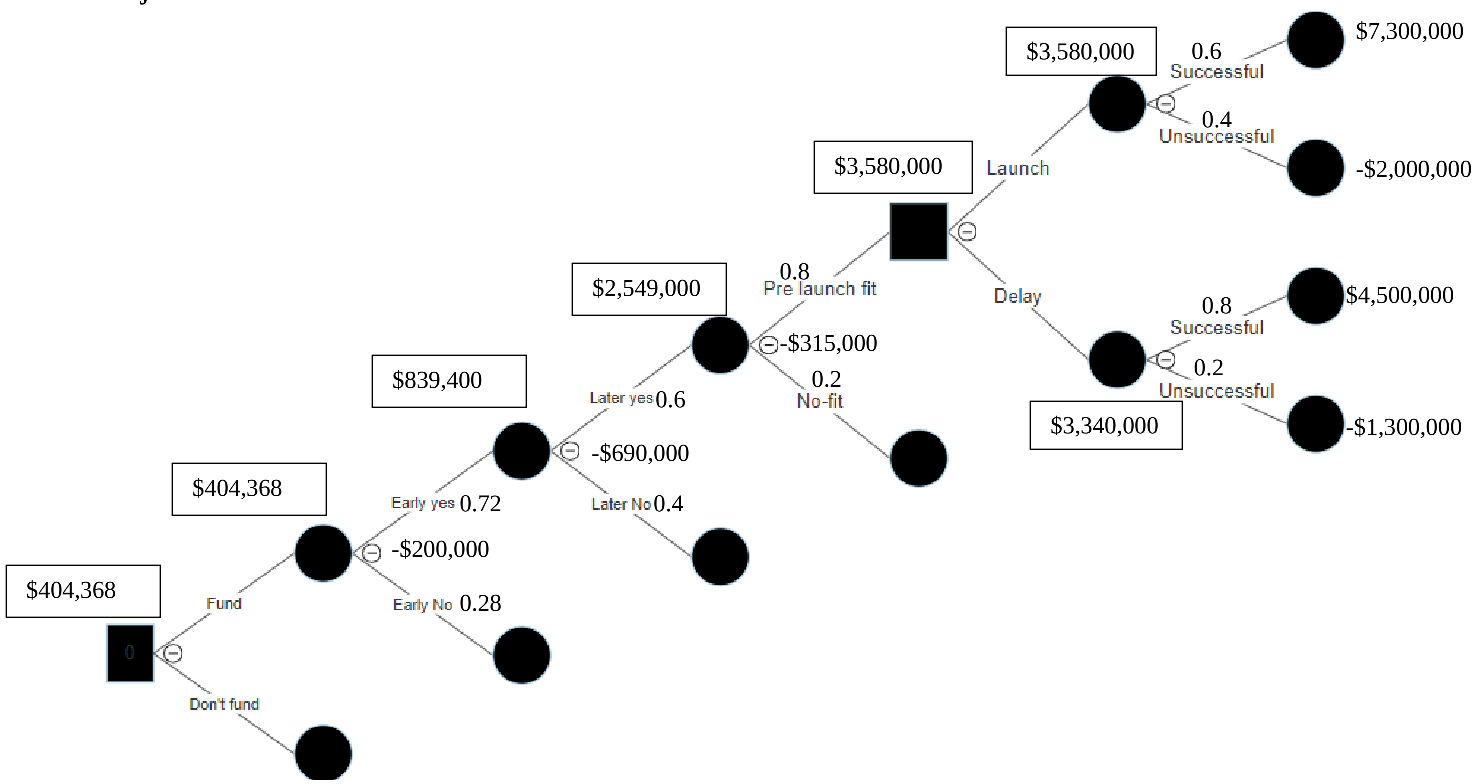
Answers to Case Problem S1.3*:* Evaluating Projects at Nexcom Systems

Project 1:



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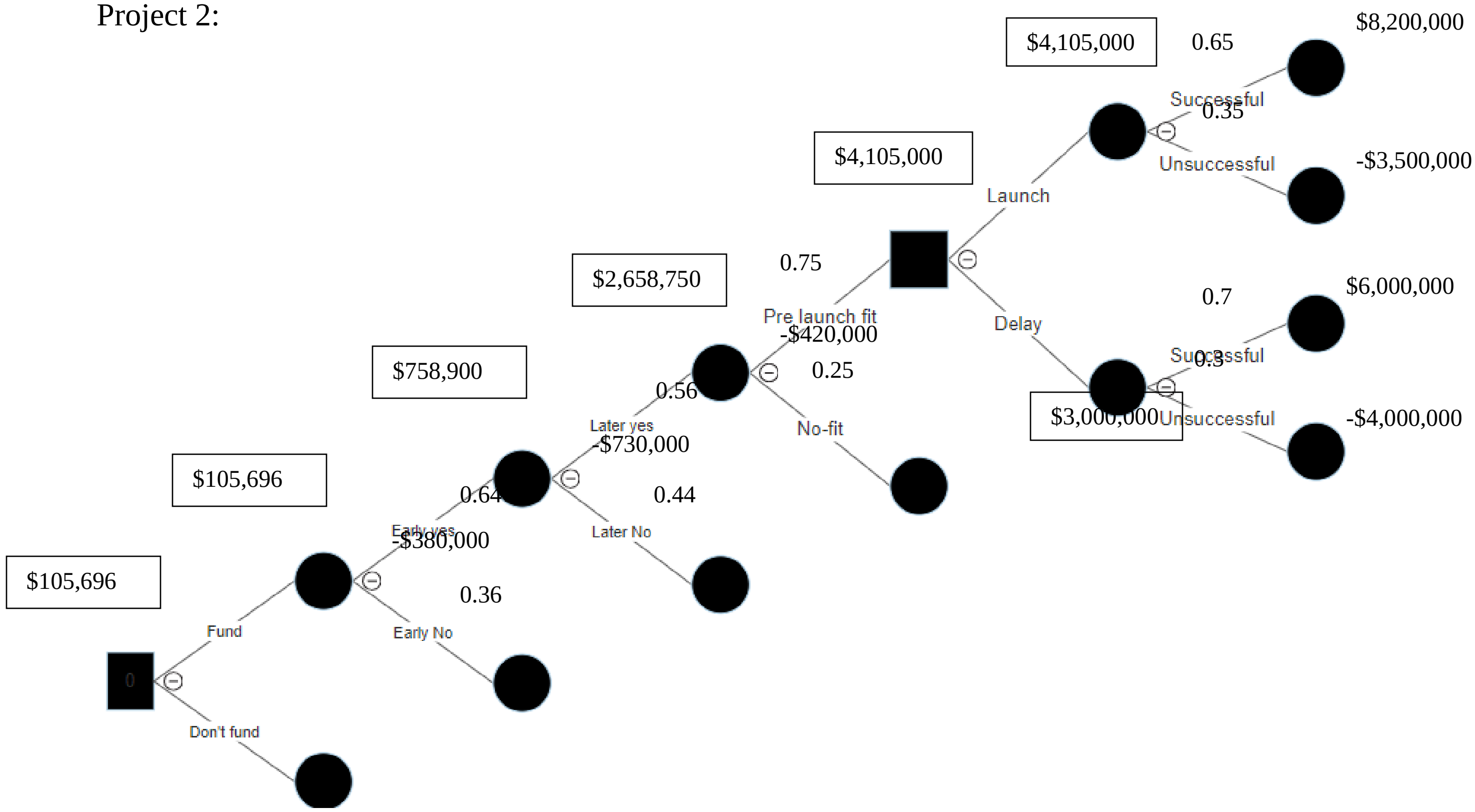
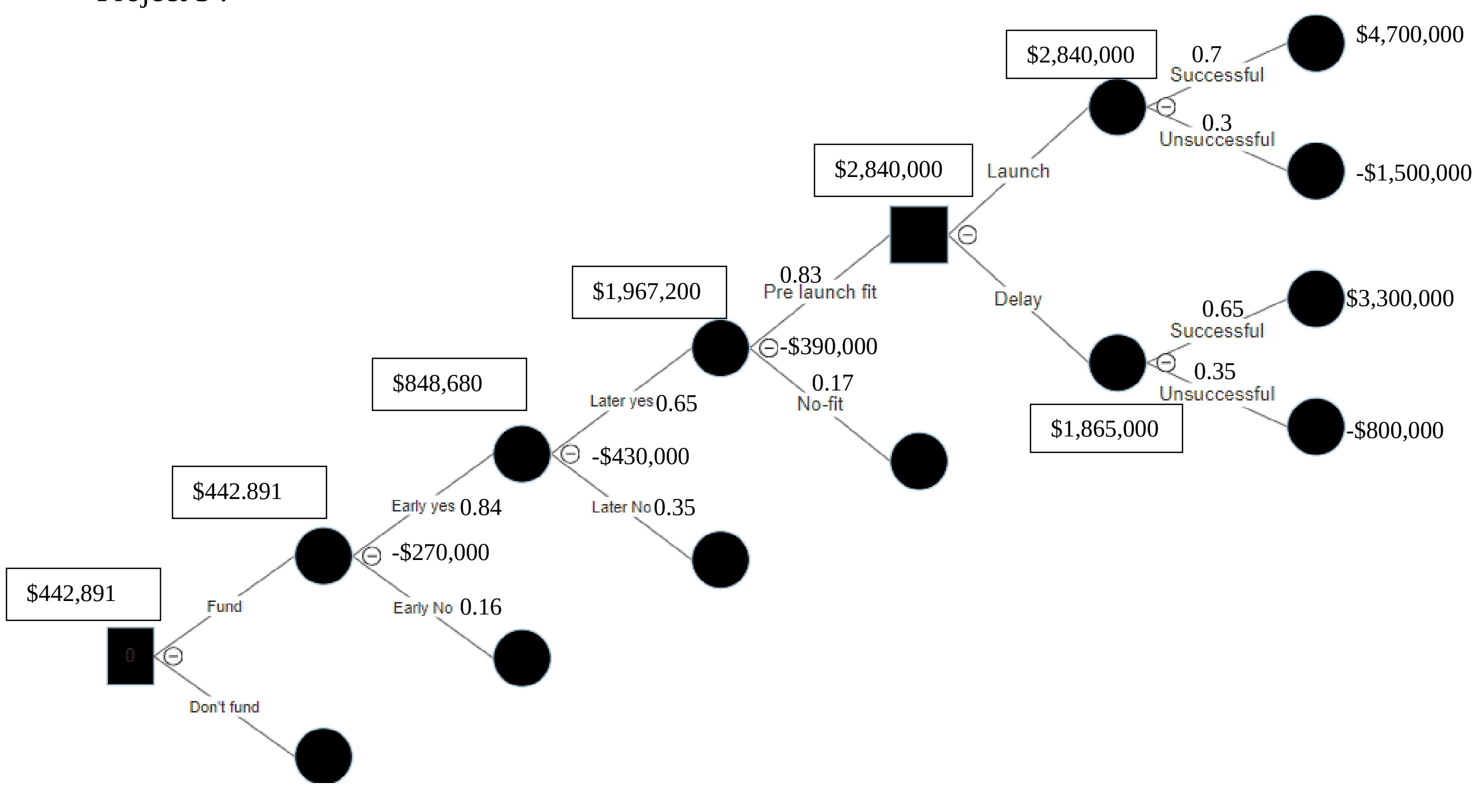
Project 2:



Project 3 :



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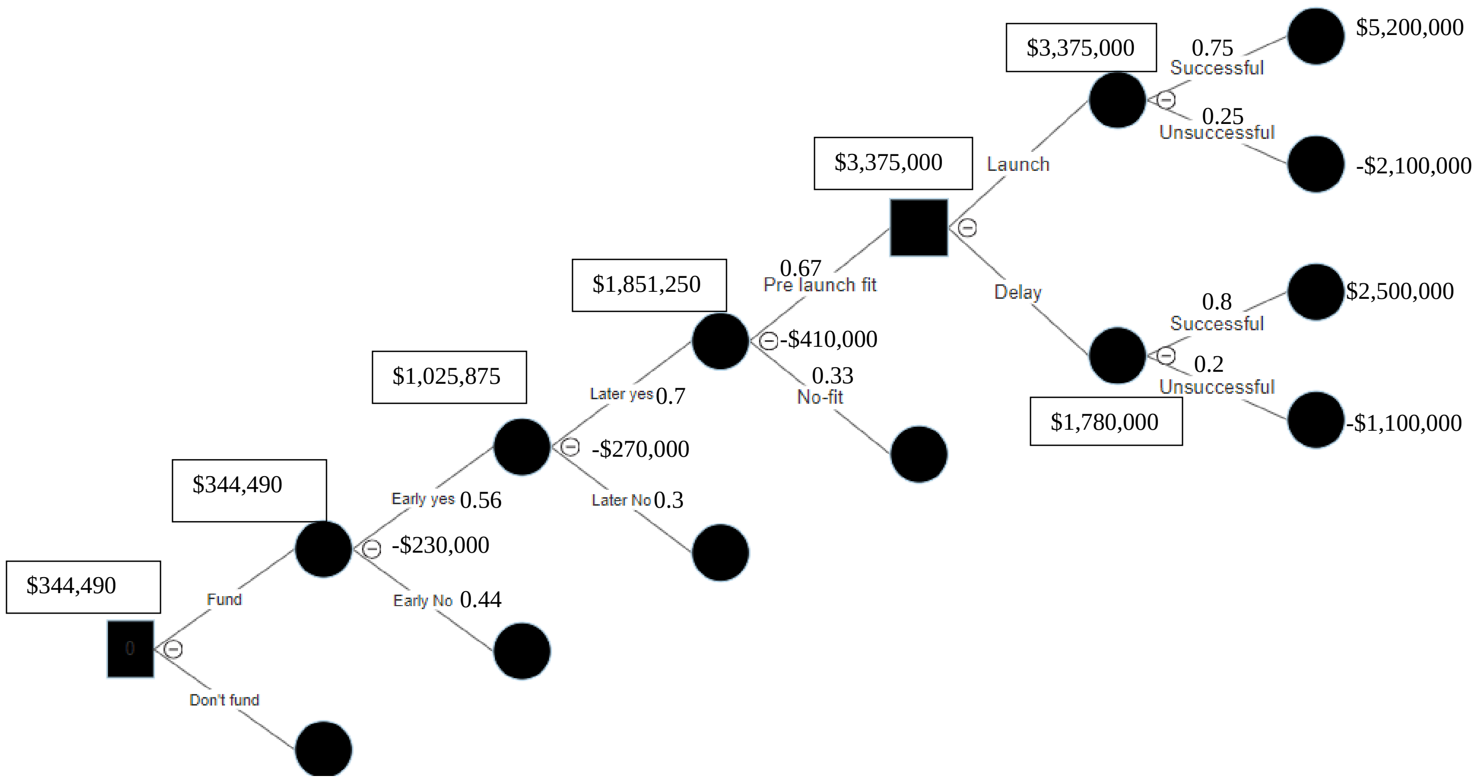
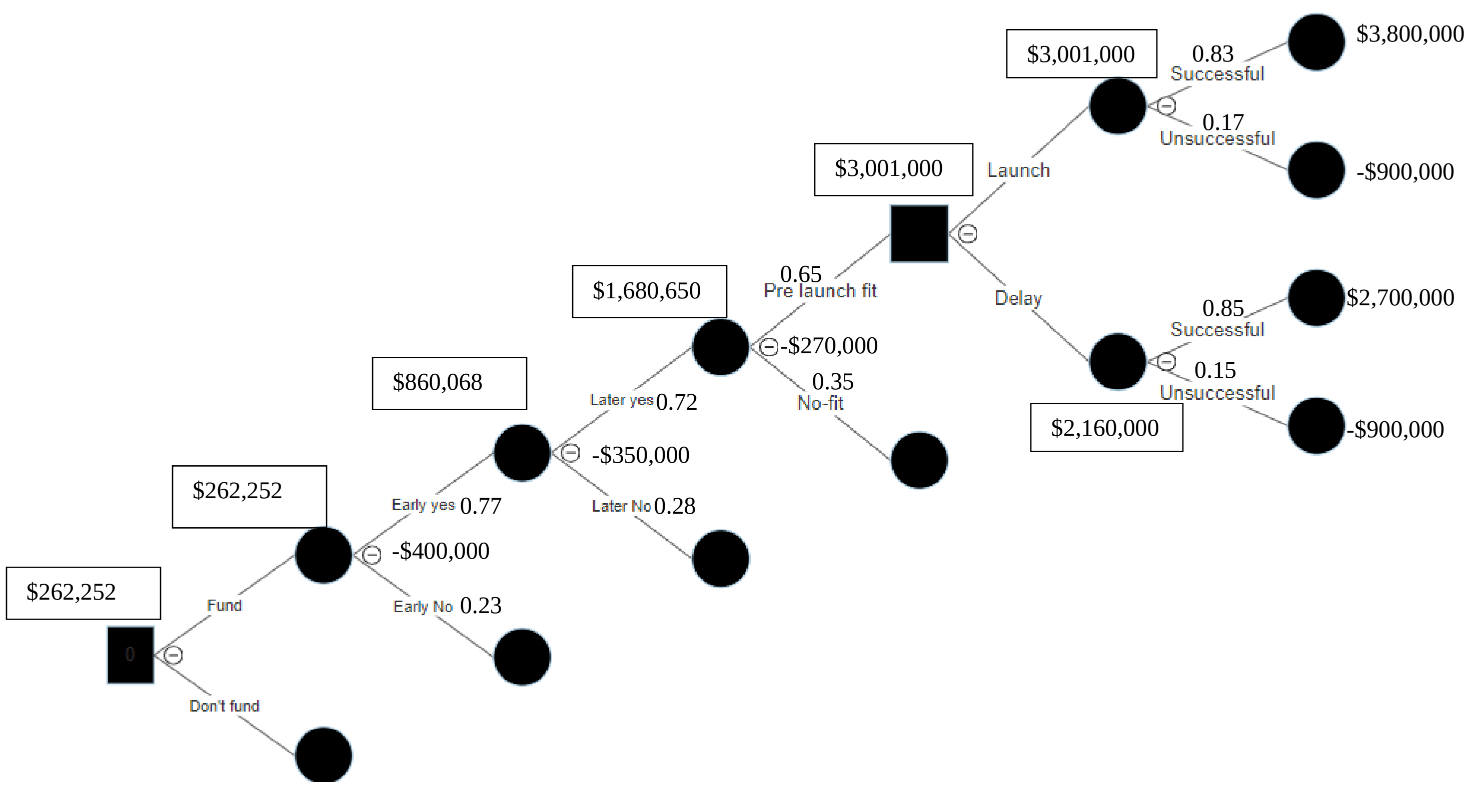
Project 4:



Project 5:



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Project	EV
1	404,368
2	105,696
3	**442,891**
4	344,490
5	262,252

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