Assignment 07

1. Problem 1

The purchase of a used pickup truck for $12,000 is being considered. Fuel and maintenance costs are $2,000 per year if the truck is driven 16,000 kilometers each year, and vary directly with mileage. Assume you will keep and use the truck for 5 years. The salvage value after five years of use decreases (from the original purchase price) by $0.07 per kilometer driven during that entire period.

(a) Find the equivalent uniform annual cost, rounded to the nearest dollar, if the interest rate is 8%.

(b) If the annual mileage is instead 24,000 km, what would the EUAC be?

(c) If the annual mileage is instead 8,000 km, what would the EUAC be?

(a) Salvage Value: $\$12,000 - 5 \times \$16,000 \times \$0.07 = \$6,400$
Net Cost: $\$12,000 - \$6,400(P/F, 8\%, 5) = \$7,644$
Annual Cost w/o Maintenance: $\$7,644 = x(P/A, 8\%, 5) \rightarrow x = \$1,915$
EUAC: $\$1,915 + \$2,000 = \$3,915$

(b) Salvage Value: $\$12,000 - 5 \times \$24,000 \times \$0.07 = \$3,600$
Net Cost: $\$12,000 - \$3,600(P/F, 8\%, 5) = \$9,550$
Annual Cost w/o Maintenance: $\$9,550 = x(P/A, 8\%, 5) \rightarrow x = \$2,392$
Fuel and Maintenance Costs: y $= \frac{\$24,000}{\$16,000} \times \$2,000 \rightarrow y = \$3,000$
EUAC: $\$2,392 + \$3,000 = \$5,392$

(c) Salvage Value: $\$12,000 - 5 \times \$8,000 \times \$0.07 = \$9,200$
Net Cost: $\$12,000 - \$9,200(P/F, 8\%, 5) = \$5,739$
Annual Cost w/o Maintenance: $\$5,739 = x(P/A, 8\%, 5) \rightarrow x = \$1,437$
Fuel and Maintenance Costs: y $= \frac{\$8,000}{\$16,000} \times \$2,000 \rightarrow y = \$1,000$
EUAC: $\$1,437 + \$1,000 = \$2,437$

2. Problem 2

Modifying an assembly line has a capital cost of $100,000, and will have no salvage value. The firm's borrowing interest rate is 7%. The revenue that the assembly line modification will create depends on whether the assembly line runs one, two, or three shifts, and on whether the product is made for three or five years.

Shifts/Day	Revenue/Year	Probability		Useful Life (Years)	Probability
1	$24,000	0.18		3	0.6
2	31,000	0.60		5	0.4
3	40,000	0.22			

(a) What is the joint probability distribution for savings per year and useful life, rounded to three decimal places?

(b) What is the net present worth for each joint scenario, rounded to the nearest dollar?

(c) Using this information, define optimistic, most likely, and pessimistic scenarios. For the 'most likely' scenario, use all of the information available, as would a financial firm that is considering loaning money to the firm. Justify your selections.

(a)

Shifts/Day	Revenue/Year	Probability	Useful Life (years)	
			3	5
1	$24,000	0.18	0.108	0.072
2	31,000	0.60	0.360	0.240
3	40,000	0.22	0.132	0.088

(b) i. Shift 1:

$$PW\ of\ 3\ Years: \$100,000 - \$24,000(P/A, 7\%, 3) = -\$37,016$$

$$PW\ of\ 5\ Years: \$100,000 - \$24,000(P/A, 7\%, 5) = -\$1,595$$

ii. Shift 2:

$$PW\ of\ 3\ Years: \$100,000 - \$31,000(P/A, 7\%, 3) = -\$18,646$$

$$PW\ of\ 5\ Years: \$100,000 - \$31,000(P/A, 7\%, 5) = \$27,106$$

iii. Shift 3:

$$PW\ of\ 3\ Years: \$100,000 - \$40,000(P/A, 7\%, 3) = \$4,973$$

$$PW\ of\ 5\ Years: \$100,000 - \$40,000(P/A, 7\%, 5) = \$64,008$$

(c) Optimistic: Shift 3, with the best PW among all shifts for both 3-year life span and 5-year life span

Pessimistic: Shift 1, with the worst PW among all shifts for both 3-year life span and 5-year life span

Most Likely:Shift 2, with the highest probabilities among all shifts for both 3-year life span and 5-year life span

3. Problem 3

Craps is a popular casino gambling game that uses two (six-sided) dice. One of the many bets available is the "Hard-way 8", which occurs if both dice come up fours when rolled. If a "hard- way 8" is rolled before a 7 is rolled or any other combination that adds to 8 is rolled, a $1 bet will typically win the player $9 (and they will get their original $1 bet back as well). If any other total number is rolled, the bet neither wins nor loses. What is the expected return for such a $1 bet, if you assume the gambler will keep playing until they either win or lose? Round to the nearest cent.

Possible ways to lose:

Roll a 7: {1,6; 2,5; 3,4; 4,3; 5,2; 6,1} $\rightarrow$ 6 combinations

Roll an 8 (no doubles): {2,6; 3,5; 5,3; 6,2} $\rightarrow$ 4 combinations

10 combinations to lose

Only way to win:

Roll a "Hard-way 8" $\rightarrow$ 1 combination

Expected Return of the $1 bet: $\frac{10}{11} \times (-1) + \frac{1}{11} \times 9 = -\$0.09$

4. Problem 4

Your firm is considering investing in a power generator to meet its own power needs and avoid paying power bills.

The first cost (initial capital cost) of a power generator is uncertain: the cost is distributed normally with a mean value of $2,000,000 and a standard deviation of $300,000. The power generator will have no salvage value.

The life of the generator is also uncertain: it may last from 6, 7, 8, 9, or 10 years. (Assume a discrete uniform distribution applies.)

Currently, the electricity power bill is $200,000 per year. If you make this investment, you will save this money every year (since you will no longer have a power bill). The borrowing interest rate (and therefore in this case the discount rate) is 4%. The annual operating cost of the power generator is expected to be $50,000 per year.

Draw 30 different random sets from the two distributions above to serve as data for the analyses below.

(a) What is the expected value of the net present worth of the plant investment?

(b) What is the standard deviation of the net present worth?

Show your work for these calculations. You can use Excel or other software capable of statistical analysis to solve this problem.

(a) -$1,031,832.08

(b) $348,638.35

See attached Excel spreadsheet for solution