**Homework Set 1**

**EGR 310**

**Answers**

**Problem 1 (10 points)**

Select the correct economic criterion (maximize profit, minimize cost, maximize benefit) for each of the following scenarios and briefly explain why: *(Chapter 1)*

* 1. A community collected $200,000 to put on a 4th of July fair, parade and fireworks show. What is the economic criterion for organizers?

 ***Max benefit, get the most out of the $200,000.***

* 1. A restaurant has found that spending on flyer advertising through the mail increases sales but at a decreasing rate as the number of flyers increase. What are the economic criteria for the restaurant?

***Max profit, spend more on advertising (input), get some more on sales (output) but at a decreasing rate.***

* 1. A services contractor received a fixed price contract to install and maintain IT equipment for the county of San Diego. What are the economic criteria for the services contractor?

***Min cost****,* ***fixed income thus minimize cost***

**Problem 2 (10 points)**

Why is step 9 of the decision-making process, audit the results, important? Why do you think firms often ignore this step? *(Chapter 1)*

***Auditing is important to learn on how to improve your estimates/processes to support your economic decisions. Companies don’t want to spend money on past decisions or the people that made them a long time ago are gone.***

Steps in the Ethical Decision Process

1.Recognize the problem

2.Define the goal or objective

3.Assemble the relevant data

4.Identify feasible alternatives

5.Select the criterion to determine the best alternative

6.Construct a model

7.Predict each alternative’s outcomes or consequences

8. Choose the best alternative

9. Audit the results

**Problem 3 (10 points)**

A bagel shop has fixed costs of $200 per day and variable costs 10 cents per bagel. How many bagels must be sold at 50 cents each to break even? To make $100 in one day? To make $200 in one day? *(Chapter 2)*

***Profit = total revenue - total cost***

***Breakeven -> profit = 0***

***0 =*** ***$0.50X – ($200 + $0.10X) = $0.40X - $200***

***X = 500 bagels***

***$100 = $0.50X – ($200 + $0.10X) = $0.40X - $200***

***X = 750 bagels***

***$200 = $0.50X – ($200 + $0.10X) = $0.40X - $200***

***X = 1000 bagels***

Excel has the function called Goal-seek that is very helpful. After a model is created you can very easily conduct the “What-if” analyses.

**Problem 4 (10 points)**

 A manufacturing plant that makes boomerangs has a fixed cost of $500/day and a variable cost of $40/hr for labor for the first 8 hours of production and $60/hr for each hour of production over 8 hours. Assume that the laborers are sent home after completing the required output and paid only for hours worked. If the output of boomerangs (production) is 75 units/hr, what are the marginal and average costs per boomerang for producing: *(Chapter 2)*

To produce 450 boomerangs –

***450/75 = 6 hrs labor***

***Avg = (6\*$40 + $500)/450 = $1.64 / boomerang.***

***Marginal = $40/75 = $0.53 / boomerang***

To produce 525 boomerangs

***525/75 = 7 hrs labor***

***Avg = (7\*$40 + $500)/525 = $1.49 / boomerang.***

***Marginal = $40/75 = $0.53 / boomerang***

To produce 675 boomerangs

***675/75 = 9 hrs labor (8 @ $40/hr and 1 @ $60/hr)***

***Avg = (8\*$40 + 1\*$60 + $500)/675 = $1.30 / boomerang.***

***Marginal = $60/75 = $0.80 / boomerang***

To produce 750 boomerangs

***750/75 = 10 hrs labor (8 @ $40/hr and 2 @ $60/hr)***

***Avg = (8\*$40 + 2\*$60 + $500)/750 = $1.25 / boomerang.***

***Marginal = $60/75 = $0.80 / boomerang***

A Marginal Cost is a variable cost of producing one more unit.

The Average Cost is the total cost divided by the number of units.

**Problem 5 (10 points)**

A company plans to design and build transport vehicles for the Army.

The cost for the design is $10M.

The cost for the test prototype is $2M.

The cost to produce and test each production vehicle is $500K.

What is the non-recurring cost?

What is the recurring cost per vehicle?

What price per vehicle must the company sell the vehicles to the government to make $50K profit per vehicle:

a) if the company sold 50 vehicles?

b) 100 vehicles?

 Why does the price per vehicle go down when production goes up? *(Chapter 2)*

***Non-recurring costs - $10M, $2M =$12M***

***Recurring cost – $0.5M/vehicle***

***Profit = Total Revenue – Total Cost***

a) If company sold 50 vehicles:

***$50K\*(50) = SP50(50) – ($12M - $500K\*(50))***

***$2.5M = SP50 \*(50) - $12M - $25M***

***Sp of 50\*(50) =$2.5M+$12M+$25M =$39.5M***

***SP50(50) = $39.5M***

Selling price per vehicle: ***SP50 =$39.5M/50 = $790K/Vehicle***

b) If company sold 100 vehicles:

***$50K\*(100) = SP100(100) – ($12M - $500K\*(100))***

***$5M = SP100 \*(100) - $12M - $50M***

***Sp of 100\*(100) =$5M+$12M+$50M =$67M***

***SP100(100) = $67M***

Selling price per vehicle: ***SP100 = $67M/100= $670K/Vehicle***

***Non-recurring costs are spread among more vehicles, thus reducing the cost per vehicle***

**Problem 6 (10 points)**

Using Fig 2-3, list some possible life cycle activities needed for a nuclear power plant. For example, for the Needs Assessment and Justification phase, you may be doing feasibility studies, projecting power needs studies, etc. Just one activity per phase is fine. *(Chapter 2)*

***Needs Assessment Studies***

***Conceptual Design Design to Key requirements.***

***Detailed Design Design to detailed requirements.***

***Production Construction, testing***

***Operational Use Staffing, Maintenance, Fuel***

***Retirement Disposal of spent fuel***

You can use the table in the Chapter 2 to complete this question.

**Problem 7 (10 points)**

Eight years ago:

the relative cost index was 60,

a 10 MW power generation facility cost $5M to build.

Today:
the cost index is 110.

What would the cost be to produce a 25MW facility today if the power sizing factor is 0.6? *(Chapter 2)*

**Power sizing**

***X/$5M = (25MW/10MW)^(.6)***

***XA=( (25MW/10MW)^(.6))\*$5M***

***X = $8.7M***

**Cost index**

***X/$8.7M = 110/60***

***X = $15.9M***

Power Sizing:

(Cost of equipment A/Cost of equipment B) = (Size of equipment A/Size of equipment B)^x

Cost Index :

(Cost at time A/Cost at time B) = (Index Rate at time A/Index rate at time B)

The “x” is the power sizing exponent.

**Problem 8 (10 points)**

You own an apartment complex with 85-bedroom units.

Each unit rents for $1250/mo.

Annual costs to operate the complex is $1M

If the vacancy rate is 5%, what profit do you get per year? *(Chapter 2)*

***85 \* (.95) \* $1,250/mo. \* 12mo – $1,000,000 = $211,250***

**Problem 9 (10 points)**

Draw a 5-year cash flow diagram representing the following cash flows to build springs:

*(Chapter 2)*

Initial investment in plant and equipment $50K

Annual maintenance: $3K after year 1 and increasing $1K per year after that

Annual production costs – $10K/year

Annual revenue - $25K/year

Step 1: Complete the table as shown below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **YR** | **Initial Investment** | **Annual Maint** | **Annual Prod Costs** | **Annual Revenue** | **Total** |
| 0 | -$50,000 |   |   |   | --$50,000 |
| 1 |   | -$3,000 | -$10,000 | $25,000 | $12,000 |
| 2 |   | -$4,000 | -$10,000 | $25,000 | $11,000 |
| 3 |   | -$5,000 | -$10,000 | $25,000 | $10,000 |
| 4 |   | -$6,000 | -$10,000 | $25,000 | $9,000 |
| 5 |   | -$7,000 | -$10,000 | $25,000 | $8,000 |

Step 2: Draw the cash-flow diagram:



**Problem 10 (10 points)**

Label each of the following as sunk cost, opportunity cost, or incremental costs: *(Chapter 2)*

* 1. You are deciding which car to buy. Car A is $24,000 and car B is $32,000. The difference in price is $8,000. What kind of cost does this represent? ***Incremental cost***
	2. Your company invested $300,000 into a study to determine the feasibility of introducing a new product line into the business. The study recommended 2 mutually exclusive feasible alternatives. What kind of cost does the $300K represent? ***Sunk cost.***
	3. You have 2 alternatives for a $10,000 investment. Investment A provides a $500 return and investment B provides a $700 return. If you choose Alternative B, what does the $500 return from Alternative A represent? ***Opportunity cost***

**Incremental Costs***:* It is the delta between the outcomes of two mutually exclusive alternatives.

**Sunk Costs***:* A Sunk cost is the money already spent as a part of the decision. Sunk costs must be ignored in engineering decisions because current decisions cannot change the past.

**Opportunity Costs***:* using resources in one activity instead of another.