

**SysEng 6103 Systems Life Cycle Costing - Summer 2020****Homework 1****Assigned:** June 17, 2020**Due:** June 24, 2020 until midnight CST**Remark 1:** This is an individual homework, no collaboration is allowed.**Remark 2:** Please show all your work and reasoning, as partial credit may be given for certain problems for legible, but inaccurate work. If I cannot easily decipher your work, it will be marked wrong.**Remark 3:** The total of 100 points are distributed as shown in brackets before the questions.

Question:	1	2	3	Total
Points:	36	44	20	100

**Submission Guidelines**

- Submissions should be in PDF file format for some questions/parts and in Microsoft Excel file format for others (indicated in bold letters before the question/part). Both files (1 pdf, 1 Excel file with multiple sheets for each relevant question and part) should be submitted through Canvas, before the due date and time.
- Filenames should start with the course code, your own name and a reference to the assignment, such as "SysEng6103\_Doe\_Jane\_HW1..."
- Use 1 Excel sheet per 1 exercise, and label sheet tabs with Exercise# and **highlight answers** in the sheet.

**1. \_\_\_\_\_ [36 points]**

**[Include in the PDF file only.]** A cable manufacturer produces various types of aluminum and copper cables which it sells directly to retail outlets through its distribution channels. The manufacturing process for producing cables includes a process called wire draw in which the aluminum and copper rods are pulled through a series of synthetic dies, which gradually decrease in size. The wires are then passed through an extruder, where either a single or a double coating of plastic is applied. These insulated wires are twisted into pairs by the Twisting and Stranding Department. The final shape is given to the wires by the Jacketing and Packaging department after carrying out the process of quality control. For each cost listed below, indicate whether it is a direct variable, direct fixed, indirect variable, or indirect fixed cost, assuming that the "units of production of each kind of wire" is the cost object.

Cost	Direct or Indirect?	Variable or Fixed?
(a) Aluminum and copper rods	Direct	Variable
(b) Insulating materials	Direct	Variable
(c) Wages for wire draw	Direct	Variable
(d) Depreciation on machineries	Indirect	Fixed
(e) Depreciation on factory building	Indirect	Fixed
(f) Insurance on factory building	Indirect	Fixed
(g) Consumable stores and dies	Indirect	Variable
(h) Wages for machine operators	Direct	Variable
(i) Power bill from a single meter	Direct	Variable
(j) Quality control	Indirect	Fixed
(k) Repairs & maintenance of machines	Indirect	Fixed
(l) Normal wastage and spoilage	Direct	Variable
(m) Store-keeper's salary	Indirect	Fixed
(n) Material testing	Direct	Variable
(o) Materials used by jacketing and Packaging department	Indirect	Variable
(p) Factory general utilities	Indirect	Variable
(q) Fuel for factory generator	Indirect	Variable
(r) Supervisors' salaries	Indirect	Fixed

## 2. \_\_\_\_\_ [44 points]

[Set up relations using factor notation and then use analytical solution, and include in the PDF file only.]

Each part below is independent.

- (a) [10 points] A manufacturer of off-road vehicles is considering the purchase of dual-axis inclinometers for installation in a new line of tractors. The distributor of the inclinometers is temporarily overstocked and is offering them at a 40% discount from the regular cost of \$142. If the purchaser gets them now instead of 2 years from now, which is when they will be needed, what is the present worth of the savings per unit? The company would pay the regular price, if purchased in 2 years. Assume the interest rate is 10% per year.

$$\text{Cost now} = 142(0.60) = \$85.20$$

$$\text{Present worth at regular cost} = 142(P/F, 10\%, 2) = 142\left[\frac{1}{(1+i)^n}\right]$$

$$142(P/F, 10\%, 2) = 142(0.8264) = \$117.35$$

- (b) [10 points] The Moller Skycar M400 is a flying car known as a personal air vehicle (PAV) that is expected to be FAA-certified. The cost is \$985,000, and a \$100,000 deposit will hold one of the first 100 "cars." Assume a buyer pays the \$885,000 balance 3 years after making the \$100,000 deposit. At an interest rate of 10% per year, what is the effective total cost of the PAV in year 3?

$$F = P(1+i)^n$$

$$F = 100,000(F/P, 10\%, 3) + 885,000 = 100,000(1.3310) + 885,000 = \$1,018,100$$

- (c) [10 points] A company that sells high-purity laboratory chemicals is considering investing in new equipment that will reduce cardboard costs by better matching the size of the products to be shipped to the size of the shipping container. If the new equipment will cost \$220,000 to purchase and install, how much must the company save each year for three years in order to justify the investment, if the interest rate is 10% per year?

$$A = 220,000(A/P, 10\%, 3) = 220,000(0.40211) = \$88,464$$

- (d) [14 points] The Owner of Blue Bayou Café usually pays his appliance (refrigerators, dish washers, and freezers) maintenance contract by the year. If he projects the annual costs shown, find the equivalent A value for years 1 through 5.

Year	Cash Flow (\$/year)	Estimated <i>i</i> per year
0	0	-
1-3	5,000	10%
4-5	7,000	12%

$$P = 5,000(P/A, 10\%, 3) + 7,000(P/A, 12\%, 2)(P/F, 10\%, 3)$$

$$= 5,000(2.4868) + 7,000(1.69)(0.7513)$$

$$= 21,322$$

$$21,322 = A[2.4868 + (1.69)(0.7513)]$$

$$A = 21,322/3.7565 = \$5,676$$

## 3. \_\_\_\_\_ [20 points]

[Use Excel built-in functions as indicated and include in the Excel file only.]

A machine that is acquired with an initial cost of \$29,000 has a life of 10 years, no salvage value, and an annual operating cost of \$13,000 for the first 4 years, increasing by 10% per year thereafter. Assume an interest rate of 10% per year.

- (a) [14 points] Prepare a cash flow table, then find the equivalent value at time 0 (i.e., the present value) using Excel built-in function NPV.
- (b) [3 points] Find the equivalent annual worth in each year over 10 years using Excel built-in function PMT. *Hint:*

*Use the present worth in the previous part and then use  $PMT$  on that.*

- (c) **[3 points]** Find the equivalent future value in year 10 using Excel built-in function  $FV$ . *Hint: Use either the present worth or the annual worth you found previously and apply  $FV$  on that.*