

IE2140 Engineering Economy
Tutorial #9 (Basic Cost Estimation Techniques)

Question 1 (based on Sullivan *et al* 2020, P3-8)

A water filtration system in an industrial process was purchased in 2014 for \$250,000. It will be replaced at the end of the year 2019. What is the estimated cost of the replacement, based on the following equipment cost index?

Year	Index	Year	Index
2014	220	2017	257
2015	238	2018	279
2016	247	2019	298

Question 2 (based on Sullivan *et al* 2020, P3-11)

The purchase price of a natural gas-fired commercial boiler (capacity X) was \$181,000 eight years ago. Another boiler of the same basic design, except with a capacity of $1.42X$, is currently being considered for purchase. If it is purchased, some optional features presently costing \$28,000 would be added to your application. If the cost index was 162 for this type of equipment when the capacity X boiler was purchased and is 221 now, and the applicable cost capacity factor is 0.8, what is your estimate of the purchase price of the new boiler?

Question 3 (based on Sullivan *et al* 2014, P3-17)

The structural engineering design section within the engineering department of a regional electrical utility corporation has developed several standard designs for a group of similar transmission line towers. The detailed design for each tower is based on one of the standard designs. A transmission line project involving 50 towers has been approved. The estimated number of engineering hours needed to accomplish the first detailed tower design is 126. Assuming a 95% learning curve,

- (a) What is your estimate of the number of engineering hours needed to design the eighth tower and to design the last tower in the project, and
- (b) What is your estimate of the cumulative average hours requires for the first five designs?

Question 4 (based on Sullivan *et al* 2020, P3-22)

In the packaging department of a large aircraft part distributor, a fairly reliable estimate of packaging and processing costs can be determined by knowing the weight of an order. Thus the weight is a cost driver that accounts for a sizable fraction of the packaging and processing costs at this company. Data for the past 10 orders are given as follows:

Weight (lbs), X	Packaging and Processing Costs (\$), Y
230	97
280	109
210	88
190	86
320	123
300	114
280	112
260	102
270	107
190	86

- (a) Fit a linear regression model for predicting packaging and processing cost.
- (b) What is the correlation coefficient for the model?
- (c) If an order weighs 250 lbs, how much should it cost to package and process it?

Question 5 (based on Sullivan *et al* 2014, P3-34)

You have been asked to estimate the per unit selling price of a new line of clothing. Pertinent data are as follows:

Direct labor rate: \$15.00 per hour
Production materials: \$375 per 100 items
Factory overhead: 125% of direct labor
Packing costs: 75% of direct labor
Desired profits: 20% of total manufacturing cost

Past experience has shown that an 80% learning curve applies to the labor required for producing these items. The time to complete the first item has been estimated to be 1.76 hours. Use the estimated time to complete the 50th item as your standard time for the purpose of estimating the unit selling price.