IE2111 ISE Principles & Practice II
Tutorial #7 (Costs Estimation and Capital Financing)

Question 1 (based on Sullivan *et a*l 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 year 2019. What is the estimated cost of the replacement, based on the following equipment cost index?

Year	Index
2014	220
2015	238
2016	247

Year	Index
2017	257
2018	279
2019	298

Question 2 (based on Sullivan *et a*l 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 capacity $1.42X$, is current being considered for purchase. If it is purchased, some optional features presently costing $28,000 would be added for 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 a*l 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 required 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

A company is considering investing in the following five independent projects. Assume that all the projects have equal life and consists of only an initial cash outflow and a single cash inflow at the end of its life.

	A	*B*	*C*	*D*	*E*	*F*
Capital investment (millions)	$10	$25	$30	$30	$5	$12
Annual rate of profit (%)	15	5	6	7.5	12	4

(*a*) If the company has $50 million available, and these funds are currently earning 5.5% interest annually from municipal bonds, which projects should the company invest in, what would be its *MARR*?

(*b*) If the company has $100 million available, and these funds are currently earning 5.5% interest annually from municipal bonds, which projects should the company invest in, what would be its *MARR*?

Question 6

What is the maximum price you will pay for a bond with a face value of $1,000 and a coupon rate of 14% paid annually, if you want a yield to maturity of 10%? Assume that the bond will mature in 10 years, and the first payment will be received in one year.

Question 7

A company sold a $1,000,000 issue of bonds with a 15-year life, paying 4% interest per year. The bonds were sold at par value. If the company paid a selling fee of $50,000 and has an annual expense of $70,256 for mailing and record keeping, what is the true rate of interest that the company is paying for the borrowed money?

Question 8

A company issues 5,000 bonds to raise funds. Each bond has a face value of $1,000 and pays a coupon of 6% of its face value every year. The bonds can be redeemed after ten years. If investors expect a yield of 8% on holding the bond till maturity,

(*a*) What will be the quoted price of the bond?

(*b*) How much money will the company raise through the bond sale?

(*c*) What is the after-tax cost of capital to the company for this bond sale if the corporate tax rate is 17%?