

**Carleton University**  
**Department of Civil and Environmental Engineering**  
**Engineering Economics (ECOR 3800A)**  
**ASSIGNMENT # 1**

**Issued May 12, 2016 Due Date: May 19, 2016 at 2:00 pm**

Drop off your location: Filing cabinet near the entrance to the Civil and Environmental Engineering office. The cabinet located to the right of room 3424 ME.

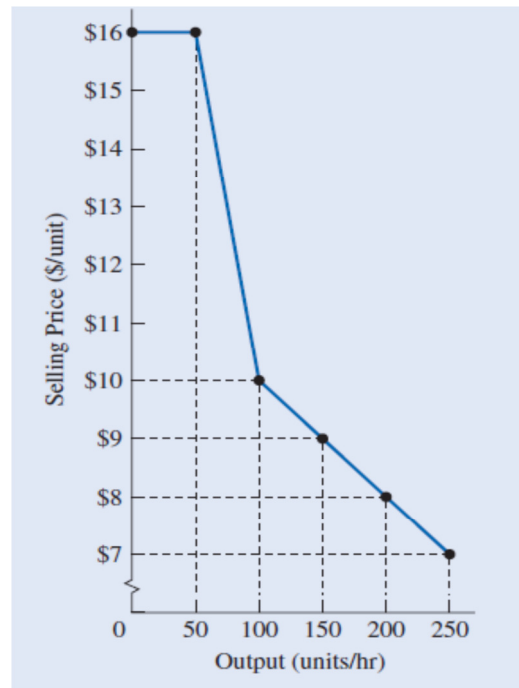
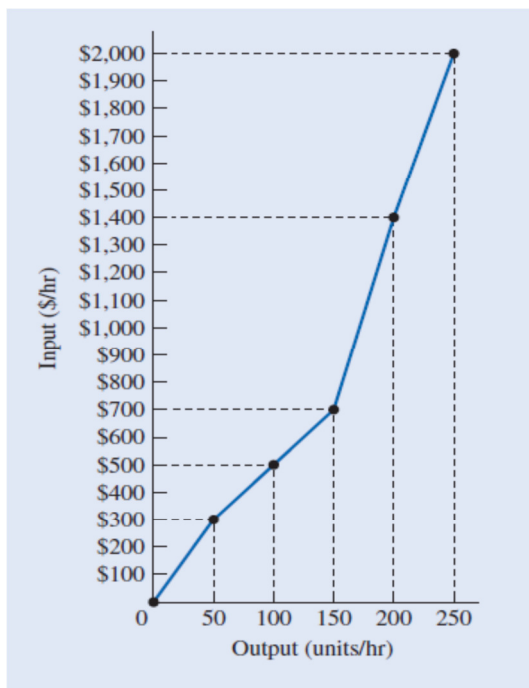
=====

**Q1**

A grower estimates that if he picks his apple crop now, he will obtain 1,500 boxes of apples, which he can sell at \$2 a box. However, he thinks his crop will increase by 120 boxes of apples for each week he delays picking, but that the price will drop at a rate of 10¢ a box per week; in addition, he estimates approximately 25 boxes a week will spoil for each week he delays picking. When should he pick his crop to obtain the largest total cash return? How much will he receive for his crop at that time?

**Q2**

On her first engineering job, Joy Hayes was given the responsibility of determining the production rate for a new product. She has assembled data as indicated on two graphs:



- (a) Select a suitable economic criterion and estimate the production rate based upon it.
- (b) Joy's boss told her: "I want you to maximize output with minimum input." Joy wonders if it is possible to meet her boss's criterion. She asks your advice. What would you tell her?

### Q3

Electricity is sold for \$0.10 per kilowatt-hour (kWh) for the first 12,000 units each month and \$0.08/kWh for all remaining units. If a firm uses 15,000kWh/month what is its average and marginal cost?

### Q4

Two new rides are being compared by a local amusement park in terms of their annual operating costs. The two rides are assumed to be able to generate the same revenue (hence the focus on costs). The Tummy Tugger has fixed costs of \$15,000 a year and variable costs of \$2.75 per visitor. The Head Buzzer has fixed costs of \$5,000 per year and variable costs of \$4.5 per visitor. Answer the following questions so the amusement park can make the needed comparison.

(a) Determine mathematically the breakeven number of visitors per year for the two rides to have equal annual costs.

(b) Develop a graph that illustrates the following (*note*: put visitors per year on the horizontal axis and costs on the vertical axis):

- accurate total cost lines for the two alternatives (show line, slopes, and equations)
- the break-even point for the two rides in terms of number of visitors
- the ranges of visitors per year where each alternative is preferred

### Q5

Assume that you save 2 cent a day for 55 years, that you deposit it in the bank at the end of each month, and that there are 30.5 days per month (you save 61 cents each month). How much do you have after 55 years, if:

(a) The bank does not pay any interest?

(b) The bank pays 3% per month interest?

### Q6

The Apex Company sold a water softener to Marty Smith. The price of the unit was \$395. Marty asked for a deferred-payment plan, and a contract was drawn up. Under the contract, the buyer could delay paying for the water softener if he bought the coarse salt for recharging the softener from Apex. At the end of two years, the buyer was to pay for the unit in a lump sum, with interest at a rate of 1.75% per quarter-year. According to the contract, if the customer stopped buying salt from Apex at any time before two years, the full payment due at the end of two years would automatically become due. Six months later, Marty decided to buy salt elsewhere and stopped buying from Apex, whereupon Apex asked for the full payment that was to have been due 18 months hence. Marty was unhappy about this, so Apex offered as an alternative to accept the \$395 with interest at 11% per semi-annual period for the six months that Marty had been buying salt from Apex. Which of these alternatives should Marty accept? Explain.

**Q7**

The local garbage company charges \$6 a month for garbage collection. It had been the company's practice to send bills to its 100,000 customers at the end of each two month period. Thus, at the end of February it would send a bill to each customer for \$12 for garbage collection during January and February. Recently the firm changed its billing date: it now sends out the two-month bills after one month's service has been performed. Bills for January and February, for example, are sent at the end of January. The local newspaper points out that the firm is receiving half its money before the garbage collection. This unearned money, the newspaper says, could be invested temporarily for one month at 2% per month interest by the garbage company to earn extra income. Compute how much extra income the garbage company could earn each year if it invested the money as described by the newspaper.

**Q8**

Jack deposited \$400,000 in a bank for six months. At the end of that time, he withdrew the money and received \$420,000. If the bank paid interest based on continuous compounding,

- (a) What was the effective annual interest rate?
- (b) What was the nominal annual interest rate?

**Q9**

The I've Been Moved Corporation (IBM) receives a constant flow of funds from its worldwide operations. This money (in the form of cheques) is deposited continuously in many banks with the goal of earning as much interest as possible for IBM. One billion dollars is deposited each month, and the money earns an average of 0.5% interest a month, compounded continuously. Assume all the money remains in the accounts until the end of the month.

- (a) How much interest does IBM earn each month?
- (b) How much interest would IBM earn each month if it held the cheques and made deposits to its bank accounts just four times a month?

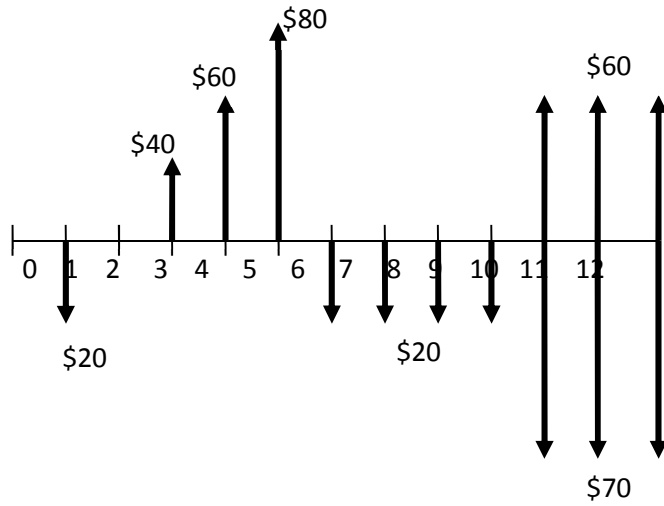
**Q10**

A forklift truck costs \$31,000. A company agrees to purchase such a truck with the understanding that it will make a single payment for the balance due in three years. The vendor agrees to the deal and offers two different interest schedules. The first schedule uses an annual effective interest rate of 13%. The second schedule uses 12.75% compounded continuously.

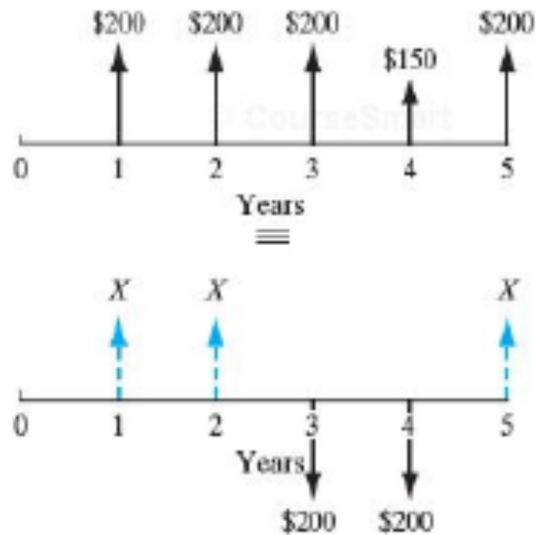
- (a) Which schedule should the company accept?
- (b) What would be the size of the single payment?

**Q11**

Calculate the present worth of the cash flow shown in the accompanying diagram, using at most three kinds of interest factors at 3% interest compounded annually.

**Q12**

Find the value of  $X$  so that the two cash flows shown in the diagram are equivalent for an interest rate of 5%.



**Q13**

For the following transactions, draw the C.F.D and find the value of G that makes the deposit series equivalent to the withdrawal series at interest rate of 10%, compounded annually.

<b>End of period</b>	<b>Deposit</b>	<b>Withdrawal</b>
0	\$1100	
1	800	
2	600	
3	400	
4	200	
5	50	
6		G
7		2G
8		3G
9		4G
10		5G