ISyE 3025, Quiz 1
Your name (PRINT):_____ Your 9-digit GT ID:_____

Honor Code Certification:

I certify that I have abided by the rules of the Georgia Tech honor code for student conduct on exams and by the specific rules on reference materials for this exam, and that I have neither given nor received assistance during this examination. I certify that I have read this statement and understand it.

Signature: _____

This quiz addresses the cost associated with oil changes. Unless explicitly stated otherwise all questions are independent. For all questions assume that the cost of an oil change is \$60, that the discount rate (interest rate) is 5%, *N*=14, and the oil has to be changed once a year.

1. [15] Your car will need an oil change every year for the next *N* years. What is the equivalent cost of these oil changes today?

$P = A(P/A, i, N)$
$P = 60(P/A, 5\%, 14)$

$$P = 60 \times \frac{1.05^{14} - 1}{0.05 \times 1.05^{14}}$$

$$P = 593.92$$

2. [10] If you are given a coupon for a free oil change, in which year should you use it in order to reduce, as much as possible, the current cost of all your oil changes?

First Year. Because it is discounted the least.

3. [15] If the cost of an oil change will grow 3% a year, what is the equivalent cost at the end of year *N* of all the oil changes?

$$60[F/gi, g = 3\%, i = 5\%, N = 14]$$

$$= \frac{60[(1+0.05)^{14} - (1+0.03)^{14}]}{.05 - .03}$$

$$= 1402.03$$

4. [15] Assume the data in Question 3. You have decided not to drive the car in year 4 and thus will not be changing the oil in that year. What is your equivalent annual cost for the oil changes over the next *N* years?

$$\{1402.03 - 60(1+.03)^{4-1}\left[\frac{F}{P}, 5\%, 14-4\right]\}[\frac{A}{F}, 5\%, 14]$$

$$= [1402.03 - 60(1.03)^3(1.05)^{10}]\frac{0.05}{1.05^{14}-1}$$

$$= 66.087$$

5. [10] How much would you be willing to pay today for a contract that covers your oil changes for the next *N* years?

Same as Question 1: 593.92

6. [10] You have discovered that if you purchase the newly invented "oil preserver" that you will only have to change the oil in your car every *other* year, i.e. only in the *even* years. The inventors of the "oil preserver" are selling the "oil preserver" with no money down and payment only at the end of year *N*. How much would you be willing to pay for the "oil preserver" at the end of year *N*?

$i_2 = (1+i)^2 - 1 = 10.25\%$

$F = A(F/A, i, N) - A(F/A, i_2, N/2)$

$$F = 60 \times \frac{1.05^{14} - 1}{0.05} - 60 \times \frac{1.1025^{7} - 1}{0.1025}$$

$$F = 1175.91 - 573.62$$

$$F = 602.30$$

7. [10] You have discovered that if you purchase the newly invented "oil preserver" that you will only have to change oil every *other* year after the first year, i.e. only in the *odd* years. The inventors of the "oil preserver" are selling the "oil preserver" with no money down and payment only at the end of year *N*. How much would you be willing to pay for the "oil preserver" at the end of year *N*?

$i_2 = (1+i)^2 - 1 = 10.25\%$
$F = A(F/A, i_2, N/2)$

$$F = 60 \times \frac{1.1025^7 - 1}{0.1025}$$

$$F = 573.62$$

8. [15] Instead of changing your oil you have discovered that you can just add oil to your car every year. However, you have to put more and more oil in every year. In the first year you have to add one quart, in the second year two quarts, in the third year three quarts, and so on so that in year *N* you have to add *N* quarts. How much would a quart of oil have to cost for you to be indifferent between this option and normal oil changes?

$$G\left(\frac{P}{A}, 5\%, 14\right) + G\left(\frac{P}{G}, 5\%, 14\right) = 593.92$$

$$\frac{\mathrm{G}[(1+0.05)^{14} - 1]}{0.05(1+0.05)^{14}} + \frac{\mathrm{G}[(1+0.05)^{14} - (0.05)(14) - 1]}{0.05^2(1+0.05)^{14}} = 593.92$$

$$9.9G + 56.55G = 593.92$$

$$66.45G = 593.92$$

$$G = 8.9$$