MATH 1330 Final Exam– Fall 2018

You must show your work in your blue book to receive credit. Allow at least one full page for each problem.

Math of Finance Formulas

Simple Interest: $S = P(1 + rt)$

Compound Interest: $S = P(1 + i)^n$, $S = Pe^{rt}$

Effective Rate: $APY = \left(1 + \dfrac{r}{m}\right)^m - 1$, $APY = e^r - 1$

Annuities: Future value $S = R\left[\dfrac{(1 + i)^n - 1}{i}\right]$, Present value $A = R\left[\dfrac{1 - (1 + i)^{-n}}{i}\right]$

Deferred Annuity: Present value $A_{(n,k)} = R\left[\dfrac{1 - (1 + i)^{-n}}{i}\right](1 + i)^{-k}$

t =number of years, r =annual percentage rate, m =number of periods per year, i =interest rate per period, n =total number of periods, $k =$ deferred period, R =periodic payment.

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1.(10p) Walmart is one of the most popular shopping centers in Lubbock. A group of customers want to buy some winter jackets from there. They will buy 40 winter jackets if the price is $400 and 45 if the price is $380. Walmart is willing to supply 28 if the price is $380 and 35 if the price is $420. Assuming that the resulting supply and demand functions are linear, find the equilibrium point for the market.

2.(10p) A lottery prize worth $1,800,000 is awarded in payments of $14,000 at the beginning of each month for 15 years. Assume that money is worth 6.8%, compounded monthly. What is the real value of the prize?

3.(15p) A hospital administrator predicts that the growth in the number of hospital employees will follow the Gompertz equation $N = 2000(0.6)^{0.5^t}$, where t represents the number of years after the opening of a new facility.

(a) (5p) What is the number of employees when the facility opens?

(b) (5p) How many employees are predicted after 1 year of operation?

(c) (5p) What is the maximum value of N that the curve will approach?

4.(10p) A sinking fund is established to discharge a debt of $100,000 in 20 years. If deposits are made at the end of each 6 months period and interest is paid at the rate of 2%, compounded semiannually, what is the amount of each deposit?

5.(10p) How much money would you need to deposit today at 9% annual interest compounded monthly to have $12,000 in the account after 6 years?

6.(10p) The Wellbuilt Company produces two types of wood chippers, economy and deluxe. The deluxe model requires 3 hours to assemble and $\frac{1}{2}$ hour to paint, and the economy model requires 2 hours to assemble and 1 hour to paint. The maximum number of assembly hours available is 24 per day, and the maximum number of painting hours available is 8 per day. If the profit on the deluxe model is $90 per unit and the profit on the economy model is $78 per unit, how many units of each model will maximize profit? Find the maximum profit.

7.(20p) Suppose a company has fixed costs of $56,000 and variable cost per unit of $\frac{4x}{9} + 333$ dollars, where x is the total number of units produced. Suppose further that the selling price of its product is $2361 - \dfrac{5x}{9}$ dollars per unit.

   (a) (5p) Find the break-even points.

   (b) (5p) Find the maximum revenue. (Round your answer to the nearest cent)

   (c) (5p) Find maximum profit.

   (d) (5p) What price will maximize the profit?

8.(10p) A simple economy has an oil industry and a steel industry. Each unit of oil output requires inputs of 0.2 units of oil and 0.24 units of steel. Each unit of steel output requires inputs of 0.4 units of steel and 0.5 units of oil.

   (a) (5p) Write the technology matrix for this simple economy.

   (b) (5p) If surpluses of 120 units of steel and 200 units of oil are desired, find the gross production of each industry.

9.(10p) A deferred annuity is purchased that will pay $10,000 per quarter for 15 years after being deferred for 5 years. If money is worth 6% compounded quarterly, what is the present value of this annuity?

10.(5p) If $1,000 is invested for x years at 10%, compounded continuously, the future value that results is
$$S = 1000e^{0.10x}.$$
What amount will result in 5 years?

11.(20p) Bill Casler bought a $9,000, 9-month certificate of deposit (CD) that would earn 8% annual simple interest. Three months before the CD was due to mature, Bill needed his CD money, so a friend agreed to lend him money and receive the value of the CD when it matured.

   (a) (10p) What is the value of the CD when it matured?

   (b) (10p) If their agreement allowed the friend to earn a 10% annual simple interest return on his loan to Bill, how much did Bill receive from his friend? (Round your answer to the nearest cent.)

12.(10p) In 2015, 88% of U.S. residents used the internet. The table shows the percent who use the internet for selected years from 2000 and projected to 2025.

Year	2000	2005	2010	2015	2020	2025
Percent	67	79	82	88	95	98

(a) (5p) Use your calculator to find the natural logarithmic function that models the percent p as a function of x, the number of years after 1990. Report the model with 4 significant digit coefficients.

(b) (5p) Use the model to predict the percentage of internet users in the United States in 2022. (Round your answer to one decimal place.)