

MATH 1330/1430 Final Exam Spring 2012

Answer each question completely. Show your work and mark your final answer in the blue book to receive full credit.

1. A manufacturer of water filters has a monthly fixed cost of \$30,000, a production cost of \$30 per unit, and a selling price of \$50 per unit.
  - (a) What is the cost function  $C(x)$  for producing  $x$  units?
  - (b) What is the revenue function  $R(x)$  for selling  $x$  units?
  - (c) What is the profit function  $P(x)$  for producing and selling  $x$  units?
  - (d) Find the break-even revenue.
2. The estimated monthly profit realizable by a camera manufacturer for producing and selling  $x$  units is given by  $P(x) = -0.04x^2 + 240x - 20,000$  dollars.
  - (a) How many cameras should be produced in order to maximize profit?
  - (b) What is the maximum monthly profit?
3. Determine the interest rate needed for an investment of \$10,000 to grow to an amount of \$18,000 in 5 years if the interest is compounded monthly.
4. Determine the present value of an ordinary annuity consisting of 24 monthly payments of \$200 each and earning interest at 6% per year compounded monthly.
5. Sara wishes to accumulate a retirement fund of \$250,000. How much should she deposit each month into her retirement account, which pays interest at the rate of 8.5% per year compounded monthly, to reach her goal upon retirement 25 years from now?
6. In a poll conducted among 200 active investors, it was found that 120 use discount brokers, 126 use full-service brokers, and 64 use both discount and full-service brokers. How many investors
  - (a) use at least one kind of broker?
  - (b) don't use a broker?
  - (c) use only discount brokers?
7. A rock group is planning a concert tour with performances to be given in five cities: San Francisco, Los Angeles, San Diego, Denver, and Las Vegas. In how many ways can the rock group arrange their itinerary if
  - (a) there are no restrictions?
  - (b) the three performances in California must be given consecutively? (San Francisco, Los Angeles, and San Diego are in California)

8. A shelf in the Metro Department Store contains 80 colored ink cartridges for a popular ink-jet printer. Six of the cartridges are defective. If a customer selects 2 cartridges at random from the shelf, what is the probability (round your answer to three decimal places) that
- both are defective?
  - at least one is defective?
9. There are 300 seniors in a high school, of which 140 are males. It is known that 80% of the males and 60% of the females have their driver's license. If a student is selected at random from this senior class, what is the probability (round your answer to three decimal places) that the student is
- a male and has a driver's license?
  - a female who does not have a driver's license?
10. Based on past experience, the manager of a DVD store has compiled the following table, which gives the probabilities that a customer who enters the store will buy 0, 1, 2, 3, or 4 DVDs. What is the expected number of DVDs that a customer who enters the store will buy?

DVDs	0	1	2	3	4
Probability	0.42	0.36	0.14	0.05	0.03

11. A video rental company has two stores A & B in a certain city. It is expected that each week, if a video is rented from store A the probability that it will be returned to store A is 60% and the probability it will be returned to store B is 40%. Similarly, if a video is rented from store B the probability it will be returned to store B is 70% and the probability it will be returned to store A is 30%. The company currently has 1000 videos at each location.
- Find the transition matrix for this Markov chain.
  - Find the number of videos the rental company has at each store 2 weeks from now.
  - What percentage of the videos will the rental company have in store B in the long run if the transition probabilities do not change?
12. The Flemings purchased a house 10 years ago for \$200,000. They made a down payment of 20% of the purchased price and secured a 30-year conventional home mortgage at 9% per year on the unpaid balance. The house is now worth \$380,000.
- Determine their monthly payment.
  - How much equity do they have in their house now (after making 120 monthly payments)?

## Finance Formulas

Simple Interest Formula:  $A = P(1 + rt)$

Compound Interest Formula:  $A = P(1 + \frac{r}{m})^{mt}$

Continuously Compounded Interest Formula:  $A = Pe^{rt}$

Effective Rate Formula for Compounded Interest:

$$r_{eff} = (1 + \frac{r}{m})^m - 1$$

Effective Rate Formula for Continuously Compounded Interest:

$$r_{eff} = e^r - 1$$

Future Value Formula:  $S = R \left[ \frac{(1 + \frac{r}{m})^{mt} - 1}{\frac{r}{m}} \right]$

Present Value Formula:  $P = R \left[ \frac{1 - (1 + \frac{r}{m})^{-mt}}{\frac{r}{m}} \right]$

$$(n = mt \text{ and } i = \frac{r}{m})$$