Finite Mathematics 143
Course Outline

1. Given a function in either tabular or functional notation, be able to evaluate. (see §1.1: 3–11)

2. Given the coordinates of two distinct points, be able to

   (a) find the slope of the line passing through them.

   (b) find the equation of the line passing through them. Also, be able write the equations in slope–intercept form.

   (see §1.2: 15–21)

3. Given the equations of two lines, be able to determine if the lines are parallel, perpendicular or neither. (see §1.2: 63–69)

4. Given the coordinates of a point and the equation of a line, be able to find the equation of the line that is parallel to the given line. (see §1.2: 71–79)

5. Be able to set up the equation(s) that describe an application such as the cost, revenue functions, car rental, straight–line depreciation. Also, be able to find the equations, which if solved would given the break–even or market equilibrium point. (see §1.3: 1–19)

6. Given two linear equations in two variables, be able to solve using either the

   (a) substitution method. (see §2.1: 1–13)

   (b) Gauss–Jordan elimination method. Also, be able to determine if the system has no solution or infinitely many solutions. In the case of infinitely many solutions, be able to explicitly write them. (see §2.1: 17–33)

7. Given three linear equations in three variables, be able to solve using the Gauss–Jordan elimination method. Also, be able to determine if the system has no solution or infinitely many solutions. In the case of infinitely many solutions, be able to explicitly write them. (see §2.2: 1–9; §2.3: 29–33)

8. Given an augmented matrix, be able to determine if it is in reduced echelon form.

9. Given two matrices be able to (if possible) perform

   (a) scalar multiplication.

   (b) addition and subtraction.

   (c) matrix multiplication.

   (see §2.4: 23–27, 31–35; §2.5: 1–5, 13–27)

10. Given a matrix of at most size 3×3, be able to find the matrix inverse. (see §2.6: 9–19)

11. Given a system of equations and the inverse of the coefficient matrix, be able to solve the system. (see §2.6: 37, 39). **Note:**

$$\begin{pmatrix} 1 & 2 & -1 \\ 1 & 1 & 2 \\ 1 & -1 & -1 \end{pmatrix}^{-1} = \begin{pmatrix} \frac{1}{9} & \frac{1}{3} & \frac{5}{9} \\ \frac{1}{3} & 0 & -\frac{1}{3} \\ -\frac{2}{9} & \frac{1}{3} & -\frac{1}{9} \end{pmatrix},$$

and

$$\begin{pmatrix} 1 & 1 & 2 & 1 \\ 2 & 0 & -1 & 1 \\ 0 & 1 & 3 & -1 \\ 3 & 2 & 0 & 1 \end{pmatrix}^{-1} = \begin{pmatrix} -\frac{1}{4} & \frac{3}{4} & \frac{5}{12} & -\frac{1}{12} \\ 0 & -1 & -\frac{1}{3} & \frac{2}{3} \\ \frac{1}{4} & \frac{1}{4} & \frac{1}{4} & -\frac{1}{4} \\ \frac{3}{4} & -\frac{1}{4} & -\frac{7}{12} & -\frac{1}{12} \end{pmatrix}$$

12. Given a system of inequalities and an objective function, (i.e., a linear programming problem), be able to

    (a) find the x and y intercepts.

    (b) plot the associated lines.

    (c) determine the feasibility region.

    (d) obtain the corner points.

    (e) find the optimal value of the objective function.

    (see §3.3: 5–17)

13. Given a hypothetical situation, be able to

    (a) determine what the objective function is.

    (b) define the appropriate variables that are needed.

    (c) construct the associated constraints.

    (see §3.4: 1–11)

14. Given a linear programming problem (Primal/Main/Forward problem), be able to construct the associated simplex tableau. (see §4.1: 9, 11)

15. Given a simplex tableau, be able to identify

    (a) the number of inequalities.

(b) the number of x variables.

(c) the number of slack variables.

(d) the basic and nonbasic variables.

(see notes)

16. Given a simplex tableau, be able to apply the simplex method, in order to obtain the optimal solution to the maximization problem. (see §4.2: 19–25)

17. Given a maximize an objective function, subject to some given constraints problem, be able to state the associated dual problem, and visa versa. (see §4.3: 5, 7)

18. Given a simplex tableau, be able to give the solutions to the maximum and minimum problem as well as the values of the slack variables. (see §4.3: 9–13)

19. Given the linear programming problem with mixed constraints, equalities and an objective function that is to be minimized, be able to construct the standard maximize problem.

20. Given a simplex tableau with variables that have negative values, be able to apply preconditioning, i.e., Phase I techniques, Furthermore, be able to identify and use the pivot to change the simplex tableau so that the basic variables are in the feasibility region.

21. Be able to apply the simple interest formula

$$I = Prt$$

$$A = P(1 + rt)$$

$$PR = M(1 - dt)$$

22. Be able to apply the compound interest formula

$$A = P\left(1 + \frac{r}{m}\right)^n$$

$$\text{Effective Rate} = \left(1 + \frac{r}{m}\right)^m - 1$$

23. If given a beginning balance and an ending balance, be able to find the effective interest rate.

24. Be able to apply the compound interest formula

$$A = R\left[\frac{\left(1 + \frac{r}{m}\right)^n - 1}{\frac{r}{m}}\right]$$

$$R = \frac{A\dfrac{r}{m}}{\left(1+\dfrac{r}{m}\right)^n - 1}$$

25. Be able to apply the Present Value/Equal Periodic Payment/Amortization formula

$$P = R\left[\frac{\left(1+\dfrac{r}{m}\right)^n - 1}{\dfrac{r}{m}\left(1+\dfrac{r}{m}\right)^n}\right]$$

and the balance of an amortization formula

$$\text{Balance} = P\left(1+\frac{r}{m}\right)^n - R\left[\frac{\left(1+\dfrac{r}{m}\right)^n - 1}{\dfrac{r}{m}}\right]$$

26. Be able to set up and evaluate a permutation problem using the formula

$$P(n,k) = \frac{n!}{(n-k)!}$$

27. Be able to apply the combination formula

$$C(n,k) = \frac{P(n,k)}{k!} = \frac{n!}{k!\,(n-k)!}$$

28. Be able to apply the multiplication principle.

29. Be able to apply the formula for defining probability, namely:

$$Pr(\text{an event}) = \frac{\#\text{ successes}}{\text{size of sample space}}$$

30. Be able to identify and solve permutation or combination problems.

31. Be able to apply the formula

$$Pr(E) + Pr(E^C) = 1, \qquad Pr(E \cup F) = Pr(E) + Pr(F) - Pr(E \cap F)$$

and for mutually exclusive events

$$Pr(E \cup F) = Pr(E) + Pr(F)$$

32. Be able to apply the conditional probability formula

$$P(E|F) = \frac{P(E \cap F)}{P(F)} \qquad \text{or equivalently} \qquad P(E|F)P(F) = P(E \cap F)$$

33. For independent events, be able to apply the formula

$$P(\cup F) = P(E) + P(F) - P(E)P(F)$$

34. Be able to apply Bayes' Rule

$$P(E_i|F) = \frac{P(E_i \cap F)}{P(F)}$$

$$P(E_i|F) = \frac{P(E_i \cap F)}{P(E_1 \cap F) + P(E_2 \cap F) + \cdots + P(E_n \cap F)}$$

$$P(E_i|F) = \frac{P(E_i)P(F|E_i)}{P(E_1)P(F|E_1) + P(E_2)P(F|E_2) + \cdots + P(E_n)P(F|E_n)}$$

35. Given a set of data, be able to construct the associated frequency table with class intervals, the mean, median and the mode.

36. Given a set of data, be able to calculate the variance and the standard deviation.

37. Given the mean and the standard deviation for a set of data, be able to calculate the z–score.

38. Given a random variable and the associated values, be able to calculate the expected value, variance and the standard deviation.

39. Given a Bernoulli/Binomial experiment, be able to calculate the associated probabilities.

40. Given a normal distribution

    (a) the mean and the standard deviation, find the probability that a score is in a given interval.

    (b) the mean and the sample space size, find the standard error, the upper and lower limits at various confidence levels.