Chapter 11 Expectations

NOTE: Whenever you see the word “communicate”, it is implied that it means to communicate both verbally and in writing!

Section 1: Expectations for the Introduction to Difference Equations I

Be able to do the following:

1. Communicate to your instructor that you know that a difference equation is used to describe how the next value in a list is found based on the previous value in the list (with the exception of the initial value).

2. Communicate to your instructor that you know that the subscripts of $y$ ($0, 1, 2, 3, \ldots, n-2, n-1, n$) are used to indicate the position of the values in the list.

3. Memorize the notation used for the initial value of the list.

4. Recognize that $y_n = a \cdot y_{n-1} + b$ is the general form of the difference equation.
   
   A. Communicate to your instructor that you know what $y_n$ and $y_{n-1}$ represent in the difference equation.
   
   B. Be aware that there will be values for $a$ and $b$ in the difference equations given throughout chapters 10 and 11. Note that when $b = 0$, the difference equation will have the form of $y_n = a \cdot y_{n-1}$

5. Be able to determine the values of $a$ and $b$ when given a difference equation.

6. When given a difference equation, show that you can:
   
   A. Generate the first few terms of the difference equation using the difference equation.
   
   B. Graph the first few terms of the difference equation.
   
   C. Solve the difference equation (i.e. find the solution of the difference equation).

7. Be able to create a difference equation from a description of a real life situation in which the next number in a list is based on the previous number in the list.

8. Communicate to your instructor that you know why the solution of the difference equation is useful (i.e. what is the purpose of the solution of the difference equation).

9. Recognize that $y_n = \frac{b}{1-a} + \left(y_0 - \frac{b}{1-a}\right) \cdot a^n$ is the solution to the difference equation (in a general form) when $a \neq 1$ in the difference equation $y_n = a \cdot y_{n-1} + b$. 
Note: The formula \( y_n = \frac{b}{1-a} + \left( y_0 - \frac{b}{1-a} \right) \cdot a^n \) will be given to you on the test so you will NOT have to memorize the formula. You will have to memorize that it is used when \( a \neq 1 \) in the difference equation.

10. When \( a \neq 1 \), plug the values of \( a \) and \( b \) (from the difference equation) of into the solution of the difference equation, \( y_n = \frac{b}{1-a} + \left( y_0 - \frac{b}{1-a} \right) \cdot a^n \), and simplify the expression as much a possible.

11. Be able to use the solution of the difference equation to find any specified value in a list.

12. Communicate to your instructor that you know the difference between a “difference equation” and the “solution of a difference equation”

13. Create a difference equation from a real life situation. (Like exercises 17 through 20 on page 532)

14. Use the “solution of a difference equation” for a real life situation. (Like exercise 27 on page 532)

**Section 2: Expectations for the Introduction to Difference Equations II**

Be able to do the following:

1. Recognize that \( y_n = y_0 + b \cdot n \) is the solution to the difference equation (in a general form) **when** \( a = 1 \) in the difference equation \( y_n = a \cdot y_{n-1} + b \).

Note: \( y_n = y_0 + b \cdot n \) will be given to you on the test so you will NOT have to memorize the formula. You will have to memorize that it is used when \( a = 1 \).

2. When \( a = 1 \), plug the value of \( b \) (from the difference equation) of into the solution of the difference equation, \( y_n = y_0 + b \cdot n \), and simplify the expression as much a possible.

**Section 3: Expectations for Graphing Difference Equations**

Be able to do the following:

1. Memorize the five steps used to graph a difference equation when \( a \) is not a 0, 1 or \( a = -1 \). (Pages 543 and 544)

2. Draw the line formed by \( y = \frac{b}{1-a} \).
3. Determine, based on the values of the difference equation and the initial value, when the graph of the difference equation is constant. (Example 1 at the bottom of page 540)

4. Memorize the condition when a graph of a difference equation is constant graph.

5. Communicate to your instructor that you know that the points are either attracted to or repelled from the line formed by $y = \frac{b}{1-a}$ when the graph is not a constant.

6. Communicate to your instructor that you know the difference between a graph that is monotonic or a graph that is oscillating.

7. Memorize the rule that is used to make the determination if the graph is monotonic or oscillating based difference equation.

8. Communicate to your instructor that you know how to tell if a graph of a difference equation is monotonic or oscillating based on the values in the difference equation.

9. Communicate to your instructor that you know the difference between a graph that is attracted to or a graph that is repelled from the line $y = \frac{b}{1-a}$.

10. Memorize the rule that is used to make the determination if the graph is attracted to or repelled from the line formed by $y = \frac{b}{1-a}$ based on the difference equation.

11. Communicate to your instructor that you know how to tell if a graph of a difference equation is attracted to or repelled from the line formed by $y = \frac{b}{1-a}$ based on the values in the difference equation.

12. When given a difference equation representing a real life situation, be able to create a general graph of the difference equation and be able to interpret information from the graph. (Like exercise 26 on page 560)

13. Describe the long run behavior (monotonic or oscillation, and repelled or attracted) based on the values in the difference equation.