Modeling is all about taking a seemingly complicated scenario we are trying to describe and finding a practical way of describing the aspects we care about studying.

STATEMENT

Consider a regular size bag of m & m candies, not peanut, just regular. Usually there are about 55 pieces in each bag. They are of different colors, but each piece almost always has an "m" pressed on one side and not the other. Hence, there are distinctions between the sides. Let us conduct an experiment (a life and death experiment) on the m & m's.

1 Death Model

Each of us will conduct this simulation in which m & m's either live or die. After opening the bag of candy put 50 of the 55 or so pieces into a small container; a paper cup will do. Before starting the experiment describe what you think will happen and offer up some assumptions in support of your description and some which might not have that much to do with what you expect to happen. Often, assumptions run into each other, so break the assumptions down to their simplest form, i.e. do not use words like and.

The Experiment

Gently shake the m & ms out onto the desk (you might want to use a paper plate to catch the m & ms and keep them clean as well). We determine for each m & m if it lives or dies. If the m shows on top this m & m dies, otherwise there is life for this m & m. Upon death you should remove the m & m from the population (set these aside as we will need them for another experiment), count and note down the number of m & ms who survive in Table 1, and thus put fewer m & ms back into your container for the next iteration. Do this over and over and record your results.

a) State your assumptions about the physical activity.

b) Offer up a description of what should happen. Care to make a prediction?

c) In Table 1 record what happened and compare with what you thought would happen.

Table 1: Modeling death of m & m's

Iterations	# of m & m's at start of iteration
0	
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

d) Compare your description/prediction with what actually happened.

e) Indicate which of your assumptions were reasonable and played a role in the experiment.

Attempt the Mathematical Model

Let us attempt to build a mathematical model of this situation. Suppose we were to define the number of m& m's alive at the start of iteration n as $a(n)$. What values would n take? What would $a(0)$ be in this case? Do you "know what $a(1)$ would be? Based on the observations and your assumptions, produce a reasonable formula for a(n), i.e. offer up a discrete function a(n), in the one variable, n, for n = 0, 1, 2, ...

    f) Discuss the reasonableness of your function model for $a(n)$.

    g) How will you measure your success as a modeler in this situation?

    h) Go ahead and check on just how good your model is at predicting your experiment and defend your rationale.

2   Death with Immigration

The experiment

In this experiment, we again start with 50 of the m & m's in a small container. Before each iteration they are mixed well, and emptied onto the desk. Just as before, if a candy has landed with the m on top, we consider it dead and remove it from the population. Otherwise, it gets to live another round. The new part in this experiment is that in addition to putting the surviving m & m's back into the container, we add 10 immigrants to each generation at the start of the new round.

Repeat steps (a)-(h) above. You may find that determining a mathematical model in the situation might be more difficult than the last, so discuss the attempts you made at producing a function $a(n)$ in this case. Without a function $a(n)$, can you make predictions about the future populations of m & m's? Will they die out or stabilize around a certain number? Explain your reasoning.