Math6e/Class Work #23

Probability: dependent probability

• Independent vs dependent probability • Simple examples for dependent probability: returning/not returning marble in a bag, total probability with fair and unfair coins

Class problems:

How did you solve it?

HW problem #5:

At a fair, you are offered to play the following game: you are tossing small balls in a large crate full of empty bottles; if at least one of the balls lands inside a bottle, you win a stuffed toy (worth about $5). Unfortunately, it is impossible to aim, so the game is just a matter of luck (or probability theory): every ball you toss has a 20% probability of landing inside the bottle.

(a) If you are given three balls, what is the probability that all three will be hits? That all three will be misses? That at least one will be a hit?

(b) Same questions for five balls.

Extension: You have to pay $1 to play.

If you get at least 1 ball (out of 3) in, you win $2.

If you get at least 1 ball (out of 5) in, you win $3.

Which game will you play?

Example 1. Factorial practice

Without using a calculator, find the answers to the following expressions

a) $\frac{5\times 6!}{2!\times 4!} =$

b) $\frac{4!}{3!} =$

c) $3! \times 0! =$

d) $\frac{4!}{0!} =$

e) $\frac{6!}{2!\times 4!} =$

f) $5! \times 5! =$

- **Independent probability:** the outcome doesn't depend on the previous outcome; we can multiply the individual probabilities
- **Dependent probability:** The outcome depends on what has happened before.
  Notation P (A|B) = probability of A given that B happened

Example 2. A bag is filled with 2 red and 3 green balls

a) to enter the game, pay $0.35, but you win $1 if you get 2 green balls in a row. You do not return the ball you have picked. Is this game worth playing?

b) if the ball is returned into the bag, is the game now worth playing?

Example 3. There are 8 coins in a bag. 5 coins are fair (50% for H) and 3 coins are unfair (60% for H). If you pick one coin from the bag and flip it twice, what is the probability to get 2 heads in a row?

Example 4: Determine the probabilities for the following cases

a) bag of 17 marbles with 3 different colors: 5 red, 6 green, 6 blue. P(R1 R2)=?

b) bag of 11 marbles: 5 red, 4 green, 2 blue. P(B1 R2)=?

c) bag of 13 marbles: 6 red, 3 green, 4 blue. P(B1 R2)=?