Binomial Distributions **Math 121 - Workshop**

*The **binomial distribution** is the probability distribution you get when you flip a fair or unfair coin N times and count the number of heads. If you flip the coin enough times, the distribution of the **total number of heads** is approximately normal with*

$$\mu = pN$$
$$\sigma = \sqrt{p(1-p)N}$$

where p is the probability of heads.

1. About 40% of Americans describe themselves as conservative. Suppose you interview a simple random sample of 2,400 Americans.

   (a) What is the expected number of conservatives in your sample?

   (b) You can be 95% sure that the number of conservatives in your sample will be between _____ and _____.

   (c) What is the probability that more than 1,000 people in the sample are conservative?

   (d) If we did get over 1,000 conservatives in our simple random sample, that would not be a representative sample of the U.S. population. Which kind of sampling error would this be?

      A. Random Error
      B. Sample Bias

2. Suppose you play roulette 100 times and bet on black every time. The bar graph below shows the probability of each possible outcome.

Probability Distribution for 100 Games of Roulette
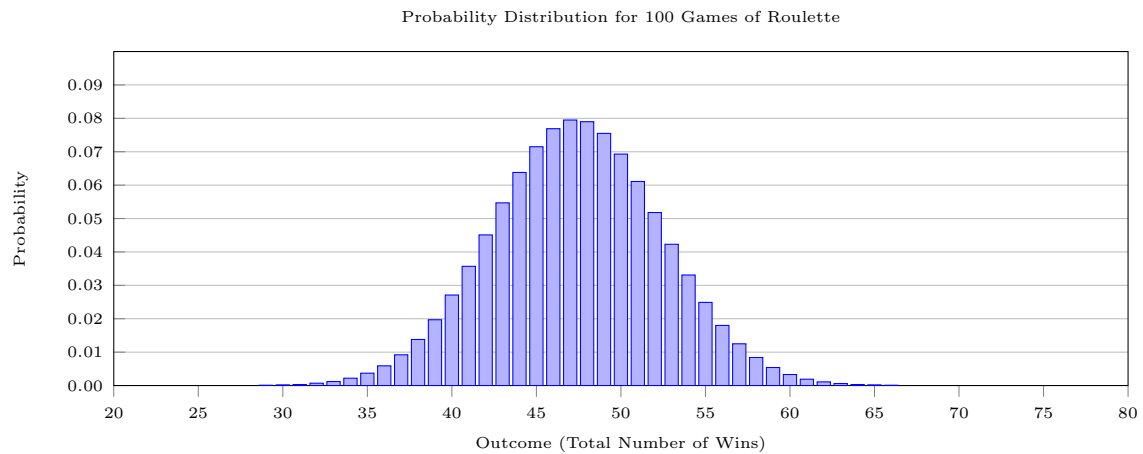
(a) Is it okay to use the normal approximation to the binomial distribution here? Explain why or why not.

(b) What is the most likely outcome?

(c) If you bet on one number (like lucky 7) instead of a color (like black), then you only have a $\frac{1}{38}$ chance of winning. What is the most likely outcome (total number of wins) if you play 100 games of roulette and bet on 7 every time?

(d) Is it okay to use a normal approximation to the binomial distribution in this case? Why or why not?