

# IS 606: Probability and Statistics for Data Analytics

## Assignment 3: More on Random Variables

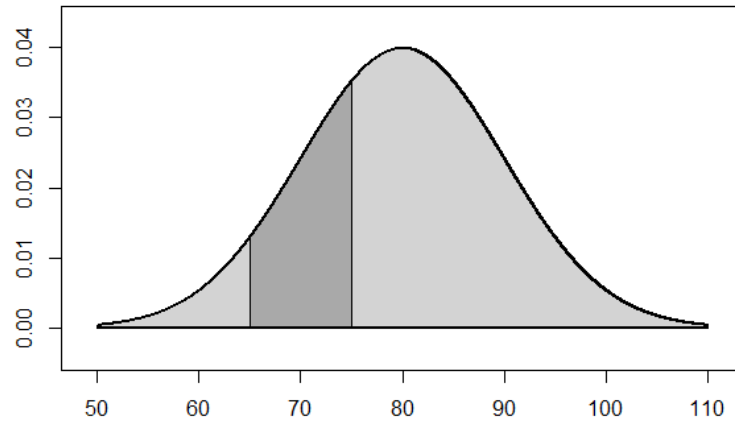
### Instructions:

- Soft deadline for this assignment (recommended due date): **Wednesday, April 1, 2015 at 11:59 p.m. EST.**
- Hard deadline for this assignment (penalties apply if late): **Wednesday, April 8, 2015 at 11:59 p.m. EST.**
- Solutions may either be typed or neatly hand written and scanned. Your submission should, however, be a single electronic file. If you scan your solutions, you must combine them into a single file. PDF files are preferred regardless of your methods.
- Assignments that either cannot be opened correctly or are illegible will receive no credit. If you have any concerns about this, please ask me before the deadline.

Each of the five problems is worth a total of 4 points.

1. A professor is constructing a multiple-choice history quiz. The quiz will have ten questions, each with four possible answers. The minimum passing score on the quiz is 60% (6 of 10 correct).
  - a. Suppose a student has not studied at all and decides to guess randomly on all ten questions. What is the probability that the student is able to pass the quiz?
  - b. For the student in the previous question, how much lower would his chance of passing be if each question had five possible answers instead of four?
  - c. Using your answer from part (a) as the probability a randomly selected unprepared student passes using this method of guessing, imagine you have 100 such students taking the quiz. How many would you typically expect to pass this quiz out of 100?
  - d. Would you recommend that the professor go through extra work to ensure that each question has five possible answers instead of just four? Why or why not?
2. Worksite injuries at a large manufacturing plant occur at an average rate of 1.5 per month. Accidents typically occur independent of one another.
  - a. What is the probability that exactly three accidents occur in a given month?
  - b. Suppose you are looking out for months with unusually high numbers of accidents. How many accidents would have to occur in a month for you to take special notice?
  - c. What is the probability that there are at most two accidents in a particular month?
3. For a particular population of river otters, the age (in months) is uniformly distributed between 0 months and 250 months. Imagine an otter is chosen at random from this population.
  - a. Is there any age you would find surprising? Explain.
  - b. What is the probability that the otter is less than 24 months old?
  - c. What is the expected age of the otter?
  - d. Which is more likely for the above population of river otters – that you select an otter less than one year old or that you select an otter more than 20 years old? Explain, giving the probability for each possibility.

4. Consider a normal distribution with mean 80 and standard deviation 10 as shown below.



Answer the following questions:

- What is the probability that an observation falls between the cutoffs of 65 and 75 (as shown in the image)?
  - What is the probability that an observation falls above the value of 92?
  - What is the probability that an observation falls below the value of 68? (How does this compare to your previous answer?)
  - What is the cutoff that separates the bottom 30 percent from the top 70 percent? (This is the same as asking what the 30<sup>th</sup> percentile is.)
  - What is the 80<sup>th</sup> percentile?
  - What are the cutoffs that contain the middle 60%? (That would be the 20<sup>th</sup> and 80<sup>th</sup> percentiles.)
5. The arrival time (measured in minutes late) for a particular flight each day is normally distributed with a mean of 10 minutes late and a standard deviation of 20 minutes late. Answer the following questions:
- What is the probability that a flight is between ten and twenty minutes late?
  - What is the probability that the flight is more than an hour late?
  - What percentage of the time would you expect the arrival time to be negative? What does this mean?
  - What is the 25<sup>th</sup> percentile for arrival times? What is the 75<sup>th</sup> percentile?