NORMAL RANDOM VARIABLES

Unit 3B: Random Variables

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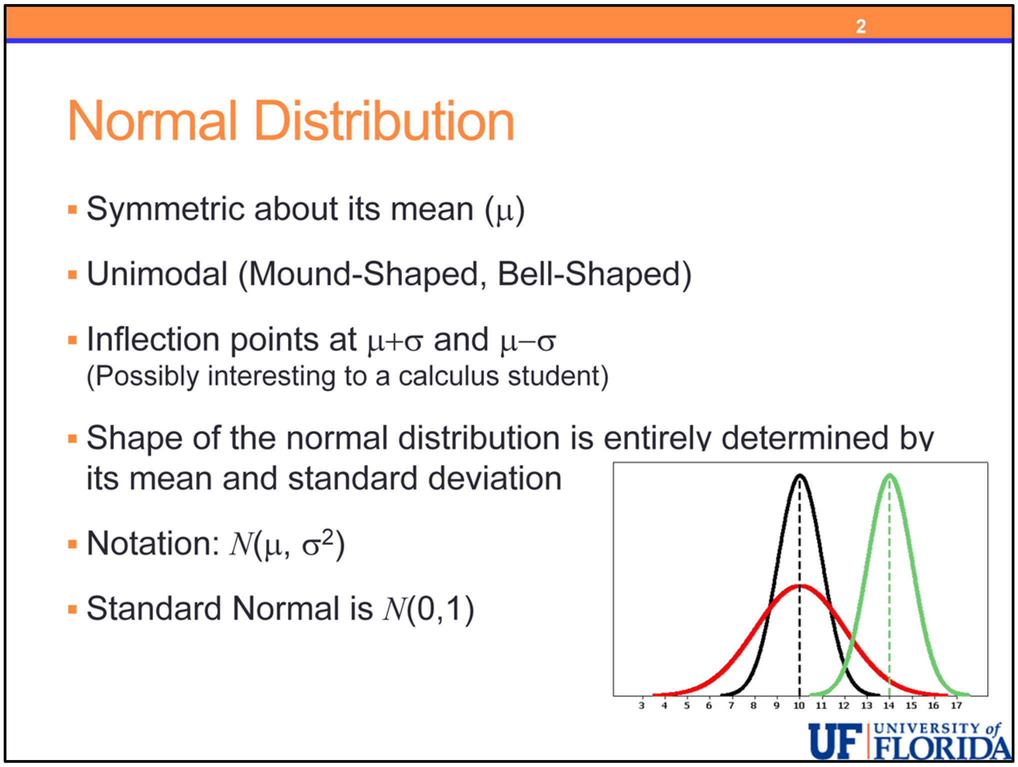
Now let’s look at the specific case for normal random variables.

We introduced the idea in Unit 1 with regard to exploratory data analysis and determining how closely our data follow a normal distribution.

Here we will learn to calculate more exact probabilities than we would be able to determine using the standard deviation rule.



In general, all normal distributions are

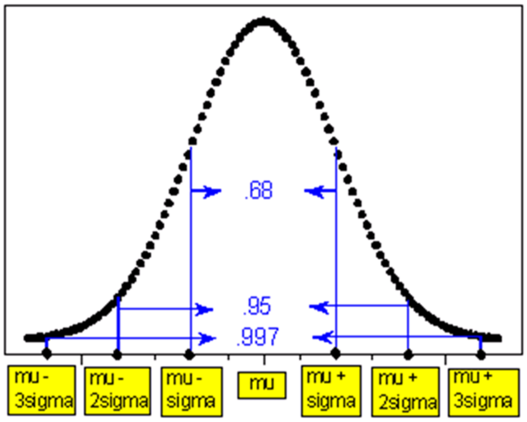
- Symmetric about the mean, mu.
- Unimodal – we could also say mound-shaped, bell-shaped
- The inflection points on the curve – where it switches from concave down to concave up – are at mu plus or minus sigma.
- The equation that provides the curve is completely determined by the mean and standard deviation

Sometimes the notation N(mu, sigma-squared) is used but generally we simply provide you with the mean and standard deviation in the problem description.

An important special case is the standard normal distribution which has a mean of 0 and a standard deviation of 1.

3

Review: Standard Deviation Rule



$$0.68 = P(\mu - \sigma < X < \mu + \sigma)$$

$$0.95 = P(\mu - 2\sigma < X < \mu + 2\sigma)$$

$$0.997 = P(\mu - 3\sigma < X < \mu + 3\sigma)$$

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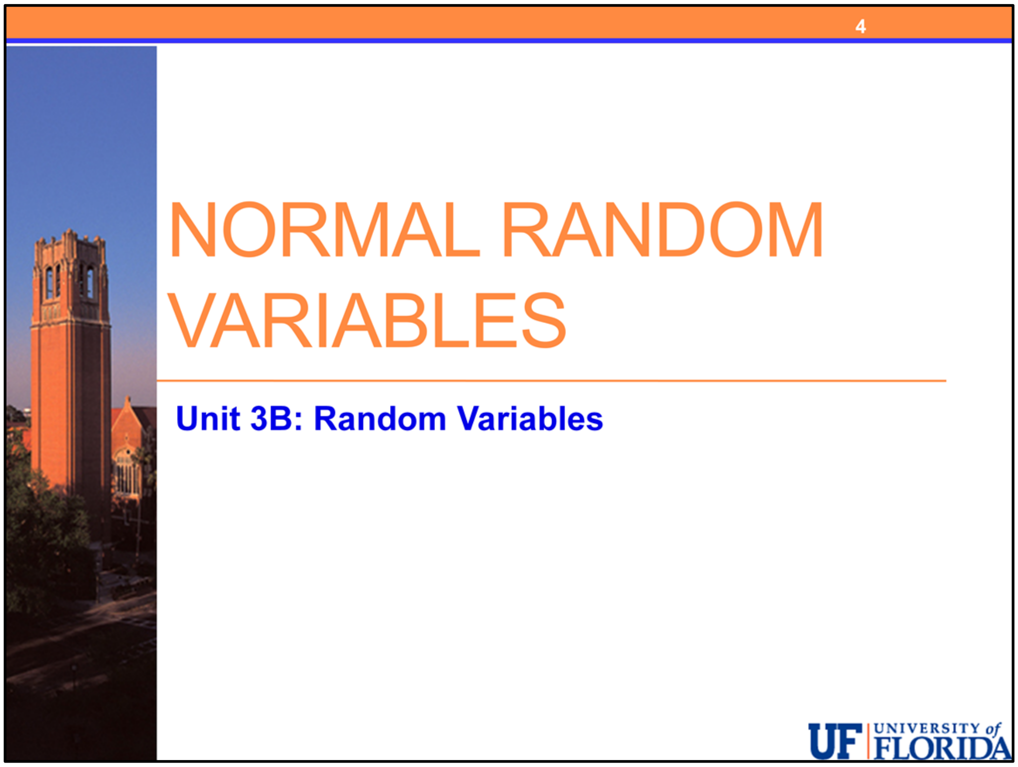
In Unit 1 we covered the standard deviation rule which we can write in probability notation as

0.68 equals the probability that X is between mu minus sigma and mu + sigma.

0.95 equals the probability that X is between mu minus 2 times sigma and mu + 2 times sigma.

And

0.997 equals the probability that X is between mu minus 3 times sigma and mu + 3 times sigma.



In this section, we will calculate probabilities more exactly using the normal table or an online calculator. Even when the values correspond to exactly 1, 2, or 3 standard deviations away from the mean, we will still need to find the more precise value of the probabilities as the values in the standard deviation rule are only approximations.