Example #1

Example

Consider a standard normal variable Z.

(a) What is the value of b such that $P(-b < Z < b) = 0.7776$?

(b) What is the value of a such that $P(a < Z < 1.33) = 0.2346$?

Example #2

Example

Diameters of a certain type of tree are known to follow a normal distribution with mean 29cm. It is known that approximately 95% of trees of this type have diameters between 17cm and 41cm. What is the standard deviation for this type of tree?

Example #3

Example

A variable X follows a normal distribution with mean μ and standard deviation σ. What is the probability that X falls within 1.7 standard deviations of μ?

Example #4

Example

Suppose we have the following information about the times taken for runners at a large track to complete various races:

- Times for the 100-metre race follow a normal distribution with mean 11.74 seconds and standard deviation 0.43 seconds.
- Times for the 200-metre race follow a normal distribution with mean 24.46 seconds and standard deviation 0.71 seconds.
- Times for the 400-metre race follow a normal distribution with mean 57.08 seconds and standard deviation 1.94 seconds.

Example #4 cont'd

(a) What proportion of runners finish the 400-metre race in less than one minute (i.e., 60 seconds)?

(b) What proportion of runners take between 23.5 and 25 seconds to finish the 200-metre race?

(c) What proportion of runners finish the 100-metre race in exactly 11.80 seconds?

(d) The slowest 7% of runners in the 100-metre race have times greater than what time?

(e) One runner finished the 100-metre race in 11.20 seconds, the 200-metre race in 23.35 seconds and the 400-metre race in 55.30 seconds. In which race did this runner do the best relative to the other runners?

(f) One runner finished the 100-metre race in a time of 12.17 seconds. What must his time be in the 200-metre race to be at the same percentile?

Example #5

Example

The yearly rainfall in Moose Jaw, Saskatchewan follows a normal distribution with mean 400 mm and standard deviation σ. In 4% of years, the city gets less than 288 mm of rain. What is the standard deviation of the amount of annual rainfall in Moose Jaw?

Example # 6

Example

Suppose on my bookshelf I have four books: A, B, C and D. Books A and B are mathematics books and books C and D are statistics books. Suppose I randomly select a book from my shelf until I get a statistics book. What is the sample space?

Example # 7

Example

Consider tossing a coin three times and each time observing Heads (H) or Tails (T). In this case, the sample space is

$$S = \{HHH, HHT, HTH, HTT, THH, THT, TTH, TTT\}.$$

Furthermore we have the following events:

- A = event exactly one Head is observed
- B = event the first two tosses are Tails
- C = event all three tosses come up Tails

(a) What outcomes are in B^c?
(b) What outcomes are in $A \cap B$?
(c) What outcomes are in $A \cup C$?

Example # 8

Example

Suppose we have the following information about a population of 1000 individuals and in particular, gender and marital status:

	Single(M_1)	Married(M_2)	Widowed(M_3)	Divorced(M_4)
Male(G_1)	129	298	13	40
Female(G_2)	104	305	57	54

(a) What is the probability a randomly selected individual from this population is male and divorced?
(b) What is the probability a randomly selected individual from this population is female?
(c) What is the probability a randomly selected individual from this population is female or single?

Example #9

Example

There are three games schedule in the National Football League (NFL) on a given Sunday. The games are shown below, where the values in brackets represent the probability of each team winning their respective game:

	Visitor	Home
Game 1:	Texans (0.6)	Lions (0.4)
Game 2:	Redskins (0.3)	Cowboys (0.7)
Game 3:	Patriots (0.8)	Jets (0.2)

(a) The outcome of interest is the set of winners for the three games. How many outcomes are contained in the sample space?
(b) What is the probability that the Lions or the Redskins win?
(c) What is the probability that exactly two of the Home teams win?

Example # 10

Example

Suppose we have the following information about customers buying alcohol at the Liquor Mart:

- 55% buy wine (W)
- 40% buy beer (B)
- 73% buy wine or beer
- 6% buy wine and vodka (V)
- 5% buy beer and vodka
- 50% buy beer or vodka
- 2% buy wine and beer and vodka

Example # 10 cont'd

(a) If we randomly select one customer, what is the probability the customer buys vodka?
(b) If we randomly select one customer, what is the probability the customer buys ONLY wine?
(c) If we randomly select one customer, what is the probability the customer does not buy beer?
(d) If we randomly select one customer, what is the probability the customer does not buy any of these types of alcohol?
(e) If we randomly select one customer, what is the probability the customer buys wine or vodka?
(f) In a random sample of 17 customers, what is the probability that exactly 10 of them buy wine?

Example # 11

Example

The contents of bottles of ginger ale produced by some company follow a normal distribution with mean 500 ml and standard deviation 4 ml. If we randomly select a sample of 15 bottles of ginger ale, what is the probability the average contents of the bottles is greater than 502 ml?

Example # 12

Example

The time it takes Stana to complete a Sudoko puzzle follows a normal distribution with mean 22 minutes and standard deviation 5 minutes. What is the probability that it takes Stana more than one hour (i.e., 60 minutes) to complete three such Sudoko puzzles?

Example # 13

Example

Consider a triangular distribution with mean 15 and standard deviation 4.

(a) If we take a random sample of 100 individuals from this population and calculate $\bar{x}$. What is the distribution of $\bar{X}$?

(b) If we take a random sample of size four from this population, what is the probability their mean is below 12?

Example # 14

Example

The amount X spent in ($) by customers in a grocery store follows some right-skewed distribution with mean $20 and standard deviation $8. What is the probability that the amount spent by the next 50 customers is less than $900 in total? (assume the next 50 customers can be considered a simple random sample.)