**Your AP Statistics summer assignment consists of two parts. Part I is to complete 7 of the 10 word problems in this document. Part II consists of a series of computer based problems to be completed on the website www.deltamath.com. For instructions on how to log into this site, please see the document "How to Set up Delta Math Account" on the Arundel High School Summer Assignments web page.**

## Basic Probability Problems for AP Statistics Summer Assignment

****You must complete any 7 of the following 10 problems to receive full credit. Full credit will only be given if all work is shown. You may use the attached formula sheet for assistance.****

1) A survey of students in a large Introductory Statistics class asked about their birth order (1 = oldest or only child) and which college of the university they were enrolled in. Here are the data:

Birth Order

College

| | $1^{st}$ (or only child) | $2^{nd}$ or later | **Totals** |
|---|---|---|---|
| Arts & Sciences | 34 | 23 | **57** |
| Agriculture | 52 | 41 | **93** |
| Human Ecology | 15 | 28 | **43** |
| Other | 12 | 18 | **30** |
| **Totals** | **113** | **110** | **223** |

Suppose we select a student at random from this class. What is the probability that this person is:

a) a Human Ecology student?

b) a firstborn student?

c) firstborn *and* a Human Ecology student?

d) firstborn *or* a Human Ecology student?

e) not firstborn, given they are a Human Ecology student?

2) The American Red Cross says that about 45% of the U.S. population has Type O blood, 40% Type A, 11% Type B, and the rest are Type AB. If someone volunteers to give blood, what is the probability that:

a) they have Type AB blood?

b) they have Type A or Type B blood?

c) they are not Type O?

3) Assume that 70% of teenagers who go take the written drivers license test have studied for the test. Of those who study for the test, 95% pass; of those who do not study, 60% pass. What is the probability that a teenager who passes the written drivers license test did not study for the test?

4) In its monthly report, the local animal shelter states that it currently has 24 dogs and 18 cats available for adoption. Eight of the dogs and 6 of the cats are male. Find each of the **conditional probabilities** if an animal is selected at random:

a) The pet is male, given that it is a cat.

b) The pet is a cat, given that it is a female.

c) The pet is female, given that it is a dog.

5) In a certain Statistics class, 57% of the students eat breakfast and 80% of the students floss their teeth. Forty-six (46) percent of students eat breakfast and also floss their teeth. What is the probability that:

a) a student in this class eats breakfast, but does not floss?

b) a student from this class, neither eats breakfast nor flosses?

c) are brushing teeth and eating breakfast independent of one another?

d) are brushing teeth and eating breakfast disjoint (mutually exclusive)?

6) The following table shows the political affiliations of American voters and their positions on the death penalty.

| | | Death Penalty | |
|---|---|---|---|
| | | Favor | Oppose |
| Party Affiliation | Republican | 0.26 | 0.04 |
| | Democrat | 0.12 | 0.24 |
| | Other | 0.24 | 0.10 |

a) What is the probability that:

i) a randomly chosen voter favors the death penalty?

ii) a Republican favors the death penalty?

iii) a voter who favors the death penalty is a Democrat?

b) A candidate thinks she has a good chance of gaining the votes of anyone who is a Republican or in favor of the death penalty. What portion of voters is that?

7) The American Red Cross says that about 45% of the U.S. population has Type O blood, 40% Type A, 11% Type B, and the rest are Type AB. Among four potential donors, what is the probability that:

a) they are all Type O?

b) no one is Type AB?

c) They are not all Type A?

d) At least one is Type B?

8) To get to work, a commuter must cross train tracks. The time the train arrives varies slightly from day to day, but the commuter estimates he'll get stopped on about 15% of work days. During a certain 5-day work week, what is the probability that he:

a) gets stopped on Monday, then again on Tuesday?

b) gets stopped for the first time on Thursday?

c) gets stopped every day?

d) gets stopped at least once during the week?

9) Surveys indicate that 15% of the students who took the SATs had enrolled in an SAT prep course. 40% of the SAT prep students were admitted to their first choice college, as were 20% of the other students. You overhear a classmate say he got into the college he wanted. What is the probability that he didn’t take an SAT prep course?

10) A city council has 7 men and 4 women. If we randomly select two members of the council to co-chair a committee, what is the probability that these chairpersons are:

a) one male, and one female

b) both female?

c) both male?

d) the same gender?

# Probability Formulas and Helpful Concepts

**The probability of any event A**:

P(A) = $\frac{\text{\# of times A occurs}}{\text{\# of total trials}} = \frac{n(A)}{n}$

**Complement Rule:**

P(not A) = $P(\overline{A}) = 1 - P(A)$, or $P(A) + P(\overline{A}) = 1$

Textbook notation: ***P* (not A) =** $P(A^C)$ = *P* (A, **c**omplement)

**Definitions:**

**Disjoint (mutually exclusive)**: Events that **cannot take place at the same time**. For example, male and female are disjoint, or mutually exclusive.

**Independent**: One event **has no affect on the occurrence of another** event. For example, If you are rolling two dice, what you get on one of the dice has no affect on what shows on the other die.

**NOTES:** Disjoint, or mutually exclusive events, **cannot be** independent

Independent events **cannot be** disjoint, or mutually exclusive

$\bigcup = union = "or"$

$\bigcap = intersection =$ *"and"*

**Addition Rule (for "or" statements):**

$$P(A \bigcup B) = P(A) + P(B) - P(A \bigcap B)$$

**NOTE:** if A and B are **mutually exclusive (or "disjoint")**, then:

$P(A \bigcap B) = 0$, **ALWAYS!**

**Conditional Probability:**

The probability that event A occurs, **given**, event B has already occurred.

$P(A|B)$ = The probability of A **given** B has already happened.

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

**Multiplication Rule (for "and" statements):**

$$P(A \cap B) = P(A) \bullet P(B|A)$$

**NOTE:** if A and B are **independent**, then:

$$P(A \cap B \cap C ... \cap Z) = P(A) \bullet P(B) \bullet P(C) \bullet ... \bullet P(Z)$$

# Helpful Formulas and Concepts

$$P(A \cap \overline{B}) = P(A) - P(A \cap B)$$

$$P(A|\overline{B}) = \frac{P(A \cap \overline{B})}{P(\overline{B})}$$

# Proof of Independence:

Events A and B are Independent **only if**:

a) $P(A \cap B) = P(A) \bullet P(B)$

or, b) $P(A) = P(A|B)$

or, c) $P(B) = P(B|A)$