DIRECTIONS:

- The actual exam will have room for your work. But this worksheet has limited room so it's a good idea to use your own paper to work out these problems.

- Try to answer all questions associated with each word problem before checking answers.

- Actual Exam 1 questions will differ from these practice questions. But the practice questions show the exam *style* and will help you to review some concepts from Topics 1–3.

- **Practice questions do not substitute for homework in exam preparation.**

- Additional Exam 1 Practice Questions are available as a PDF file on the Exams link from the main Stats website (not ICON.) Answers for those questions are shown on the last page.

Questions 1–6.

Suppose that a Ford car dealership in Iowa City conducts a telephone survey of Iowa City residents which records two items: whether or not the resident currently owns a Ford vehicle, and the response to the survey question "Do you plan to purchase a new Ford vehicle within the next 12 months?" Results of the survey are shown below.

		Currently own a Ford vehicle?		
		Yes	No	Total
Plan to purchase	Yes	12	84	96
new Ford vehicle	No	52	390	442
in next 12 months?	No Opinion	10	62	72
	Total	74	536	610

Consider the following events:

Event A: Iowa City resident answers Yes to the survey question.

Event B: Iowa City resident answers No to the survey question.

Event C: Iowa City resident offers no opinion about the survey question.

Event F: Iowa City resident currently owns a Ford vehicle.

Event N: Iowa City resident purchases a new Ford vehicle within the next 12 months.

The Ford dealership knows the following conditional probabilities from past experience:

$P\big(N \mid (A \text{ and } F)\big) = 0.639$ (**Tip:** Translate the event $N \mid (A \text{ and } F)$ into English.)

$P\big(N \mid (B \text{ and } F)\big) = 0.013$

$P\big(N \mid (C \text{ and } F)\big) = 0.042$

Now consider the **Six Steps of Inference**, where **Step 1** is given by

Question: What percentage of Iowa City residents who currently own Ford vehicles will purchase a new Ford vehicle within the next 12 months?

1. Identify **Step 2:** What population is associated with the question in **Step 1**?

    (a) All current owners of Ford vehicles

    (b) All Iowa City residents who plan to purchase a new Ford vehicle within the next 12 months

    (c) All Iowa City residents who currently own Ford vehicles

    (d) All Iowa City residents

    (e) All Iowa City residents who answer the survey

2. Identify **Step 3:** What sample is taken from the population?

    (a) The 96 Iowa City residents who are surveyed and plan to purchase a new Ford vehicle within the next 12 months

    (b) The 536 Iowa City residents who are surveyed and do not currently own a Ford vehicle

    (c) All Iowa City residents

    (d) The 610 Iowa City residents who are surveyed

    (e) The 74 Iowa City residents who are surveyed and currently own Ford vehicles

3. Identify **Step 4:** What variable or variables are measured on each unit in the sample?

    (a) Two variables are measured: the response to the survey question and a Yes or No answer to whether the Iowa City resident currently owns a Ford vehicle.

    (b) Three variables are measured: "Yes", "No", and "No Opinion" to the survey question.

    (c) The only variable measured is the response to the survey question.

    (d) The only variable measured is a Yes or No answer to whether the Iowa City resident currently owns a Ford vehicle.

    (e) No variables are measured.

4. Find P(A|F).
    (a) 0.020   (b) 0.121   (c) 0.125   (d) 0.157   (e) None of the answers is correct
    to the third decimal place

5. What is the answer to the question considered in **Step 1**?
    (a) 2.0%   (b) 16.2%   (c) 11.9%   (d) 11.2%   (e) None of the answers is correct
    to the first decimal place

6. Suppose that there are 2205 Iowa City residents who currently own Ford vehicles and that the average price of a new Ford vehicle purchased within the next 12 months is projected to be $22,150. What is the estimated total spending on new Ford vehicles over the next 12 months by Iowa City residents who currently own Ford vehicles?

    (a) More than $5,000,000

    (b) Between $4,000,000 and $5,000,000

    (c) Between $3,000,000 and $4,000,000

    (d) Between $2,000,000 and $3,000,000   (e) Less than $2,000,000

Questions 7–8.

Twelve students enrolled in Stat 1030 were surveyed for the number of hours that they spent studying Stats last weekend. The survey answers are

0.0   0.9   2.6   9.6   0.0   1.9   4.9   2.4   2.6   0.0   1.3   7.7

7. Suppose that the number of weekend hours spent studying Stats by all Stat 1030 students is not bell-shaped. What's the best estimate of the maximum number of weekend hours spent studying Stats by the 25% of Stat 1030 students who study the least?

   (a) 0.0   (b) 4.9   (c) 5.9   (d) 9.9   (e) None of the answers is correct to the first decimal place

8. Now suppose that the number of weekend hours spent studying Stats by all Stat 1030 students is bell-shaped. What's the best estimate of the minimum number of weekend hours spent studying Stats by the 2.5% of Stat 1030 students who study the most?

   (a) 0.0   (b) 4.9   (c) 5.9   (d) 9.9   (e) None of the answers is correct to the first decimal place

Questions 9–10.

Psychologists tend to believe that there is a relationship between aggressiveness and order of birth. To test this belief, a psychologist chose 500 elementary school students at random and administered to each a test designed to measure the student's aggressiveness. Each student was classified into one of four categories, with results shown below.

	Firstborn	Not Firstborn
Aggressive	15%	15%
Not Aggressive	25%	45%

9. Is whether or not a student is firstborn related to aggressiveness?

   (a) Yes   (b) No   (c) Impossible to determine

10. Suppose that the psychologist is scheduled to interview a student whom she has never met. If the student is firstborn, does this indicate a general tendency toward or away from aggressive behavior?

   (a) The general tendency is toward aggressiveness.

   (b) The general tendency is away from aggressiveness.

   (c) There is no general tendency since aggressiveness is unrelated to order of birth.

   (d) None of the answers is incorrect.

Answers

1. **(c)**   The population is the *precise* set of interest and so is <u>not</u> all Iowa City residents.

2. **(e)**   The sample is the subset of units in the population <u>which are actually measured</u>.

3. **(a)**

4. **(e)**

$$P(A|F) = \frac{P(A \text{ and } F)}{P(F)} = \frac{12/610}{74/610} = \frac{12}{74} = \boxed{0.162}$$

Therefore none of the answers listed is correct to the third decimal place.

5. **(c)**

$$P(N|F) = \frac{P(N \text{ and } F)}{P(F)}$$

We can see that $P(F) = 74/610 = 0.1213$

But how can we calculate $P(N \text{ and } F)$?

Those people who currently own a Ford (F) and who <u>actually buy</u> a new Ford (N) can be divided into three groups, depending on whether they <u>plan</u> to buy a new Ford (A, B, C):

$P(N \text{ and } F)$
$= P(N \text{ and } F \text{ and } A) + P(N \text{ and } F \text{ and } B) + P(N \text{ and } F \text{ and } C)$
$= P(A \text{ and } F) P\big(N \mid (A \text{ and } F)\big) + P(B \text{ and } F) P\big(N \mid (B \text{ and } F)\big) + P(C \text{ and } F) P\big(N \mid (C \text{ and } F)\big)$
$= \dfrac{12}{610}(0.639) + \dfrac{52}{610}(0.013) + \dfrac{10}{610}(0.042)$
$= 0.0126 + 0.0011 + 0.0007 = 0.0144$

Therefore $P(N|F) = \frac{0.0144}{0.1213} = 0.1187 = \boxed{11.87\%}$

6. **(a)**

Estimated spending $=$ (# new Fords) (avg. price per Ford)
$= (2205)(0.1187)(22{,}150) = \boxed{\$5{,}798{,}077.49}$

7. **(a)**

8. **(e)**

The answer is 9.0 correct to one decimal place. So none of the answers is correct.

9. **(a)**

Event A: firstborn
Event B: aggressive

There are two different ways you can reason for Question 9:

(1) Does B depend on A?

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)} = \frac{0.15}{0.40} = 0.375$$

Since $P(B|A) = 0.375 \neq 0.30 = P(B)$, B depends on A so the two events <u>are</u> related.

(2) Does A depend on B?

$$P(A|B) = \frac{P(A \text{ and } B)}{P(B)} = \frac{0.15}{0.30} = 0.50$$

Since $P(A|B) = 0.50 \neq 0.40 = P(A)$, A depends on B so the two events <u>are</u> related.

10. **(a)** The general tendency is <u>toward</u> aggressiveness since 37.5% of firstborns are aggressive, greater than the 30% of all students who are aggressive.