Lesson 3.1.5

3-36. a. $\frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$

b. The probability that she flips "heads" and tells the truth is $\frac{1}{6} \cdot \frac{1}{2} = \frac{1}{12}$, while the probability that she flips "tails" and lies is $\frac{5}{6} \cdot \frac{1}{2} = \frac{5}{12}$. Therefore, the overall probability that she says "heads" is $\frac{1}{12} + \frac{5}{12} = \frac{1}{2}$.

3-37. a. Answers vary, see table at right.

Lily's report	Thief's hair: Red $\frac{5}{100}$	Thief's hair: Not Red $\frac{95}{100}$
Correct $\frac{4}{5}$		
Incorrect $\frac{1}{5}$		

b. 4

c. There are two situations which would cause Lily to claim the thief had red hair: if the thief had red hair and Lily is correct (which is $\frac{5}{100} \cdot \frac{80}{100} = \frac{1}{25}$) and if the thief does not have red hair and Lily is incorrect (which is $\frac{95}{100} \cdot \frac{20}{100} = \frac{19}{100}$). Since $\frac{19}{100} + \frac{1}{25} = \frac{23}{100}$, then they can expect she will say 23 students had red hair.

d. $\frac{4}{23}$ = 17%

e. Supposing that it was initially equally likely that any student was the thief, Lily's statement still leaves it unlikely (only 17%) that a Measley was the thief.

f. No, but you have reasonable doubt. These are all probability calculations, so while it is improbable that a Measley is guilty, it is still possible.

3-38. a. See possible diagram at right. Cell A is the number of people correctly identified as HIV positive. Cell B is the number correctly identified as <u>not</u> positive. Cell C is the number the test failed to identify as positive but who were. Cell D is the number identified as HIV positive who are not.

	100 are actually sick	99,900 are not sick
test correct 0.99	A 99	B 98,901
test wrong 0.01	C 1	D 999

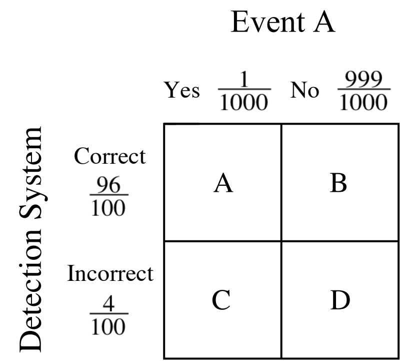
b. Using the model given in part (a), 100 people are actually sick (1 with an incorrect test), but 999 are told they are sick, but are actually not. This is almost 10 times as many people.

c. 99 people who are HIV positive are identified as positive, but 999 people who are not HIV positive are also (mis-)identified as positive. $\frac{999}{99+999} \approx 91\%$ of the positives are *false* positives.

d. Answers vary. See the "Suggested Lesson Activity." When testing is of the general population is voluntary, the percentage of positives that are false decreases because a much smaller percentage of HIV free people are tested.

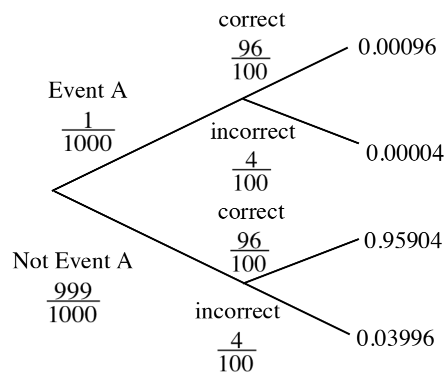
e. Yes. The accuracy of the HIV test is not changed depending on whether or not the person actually has HIV. A table of conditional probabilities confirms this.

3-39. a. See possible diagram at right. Cell A is the proportion of times the system correctly activated the alarm. Cell B is the proportion of times the alarm was correctly not activated. Cell C is the proportion of times A happened and the alarm was incorrectly not activated. Cell D is the proportion of times A did not happen and the alarm was activated. Or see the tree diagram below right.

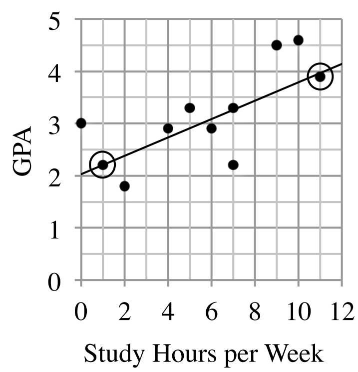


b. $\frac{0.03966}{0.03966+0.00096} = 97.6\%$

c. Yes, it is independent because the accuracy of alarm is the same regardless of whether event A occurs or not. Confirm with a table of conditional probabilities.



3-40. a.

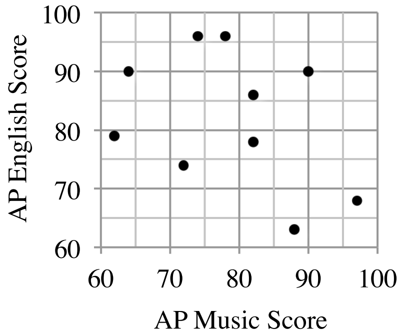


b. Answers may vary. Using the two points (11, 3.9) and (1, 2.2), $y = 2.03 + 0.17x$. The LSRL is $y = 2.25 + 0.15x$.

c. The slope indicates that a student's GPA is expected to increase by 0.17 points for every additional hour of studying per week. The y-intercept predicts that students who do not study at all will have a GPA of 2.03.

d. The form is linear; it does not appear to be curved nor simply a collection of randomly scattered points. The direction is positive; in general, students who study more also have higher GPAs. A student's GPA is expected to increase by 0.17 points for every additional hour of studying per week. The strength is moderate: it is strong enough to easily see its form, but there is scatter about the line. There do not appear to be any outliers.

3-41. a.

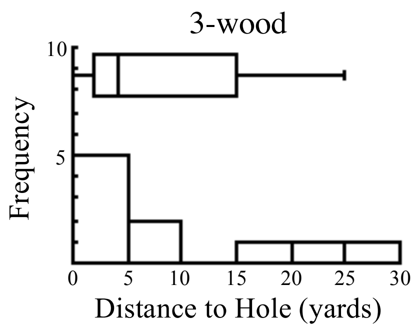


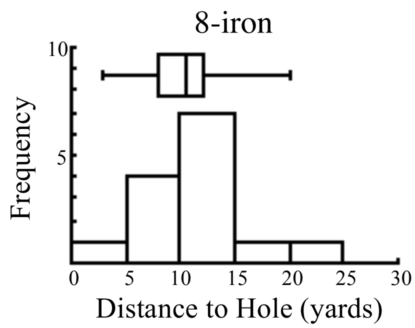
b. $\hat{y} = 112.1 - 0.38x$. Where x is the AP Music Score and $\hat{y}$ is the predicted AP English Score.

c. An increase of 1 point in the music score results in a predicted decrease of 0.38 points in the English score. The y-intercept would mean that a student who scored 0 on the music test is expected to score 112 on the English test. This does not make sense. The y-axis is far outside of the data and represents an extrapolation. (Prediction models of all types are unreliable when you extrapolate them.)

d. There is a lot of scatter around the line of best fit. $r = -0.373$. The linear association is negative and weak. There are no apparent outliers.

3-42. a.





b. Median since the distribution is not symmetrical. 3-wood median is 4 yards, and 8-iron median is 10.5 yards; on average he is 6.5 yards closer with the 3-wood.

c. Possible answer: Josh should use the 3-wood. The median is much closer to the hole; some students may be thinking about the consistency also, which is an excellent preview to the next problem.

3-43. a. 3-wood IQR is 13, and 8-iron IQR is 4. Josh is much more consistent with the 8-iron.

b. Between the first and third quartile, between 2 yards and 15 yards from the hole.

c. The typical interval of distances for the 8-iron is in the middle of the 3-wood interval. So the 8-iron is not so clearly different from the 3-wood. If there is a hazard very close to the hole, Josh may prefer the consistency of the 8-iron.