$$s^2 = \frac{\sum\limits_{i=1}^{n} (y_i - \bar{y})^2}{(n-1)}$$

$$P\{E_1 \cup E_2\} = P\{E_1\} + P\{E_2\} - P\{E_1 \cap E_2\}$$

$$P\{E_1 \cap E_2\} = P\{E_1\}P\{E_2| E_1\}$$

$$\mu_Y = \sum y_i P\{Y = y_i\}$$

$$\sigma_Y^2 = \sum (y_i - \mu_Y)^2 P\{Y = y_i\}$$

$$= E(Y^2) - (E(Y))^2$$

$$P\{Y = j\} = {}_nC_j\, p^j\, (1 - p)^{n-j}$$

$$\mu_Y = np$$

$$\sigma_Y^2 = np(1 - p)$$

$$Z = \frac{(Y - \mu)}{\sigma}$$

$$Z = \frac{\bar{Y} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

Part I: Answer eight of the following nine questions. If you complete more than eight, I will grade only the first eight. Five points each.

Use this fruit fly experiment to answer any of the first three questions.
In a behavioral study of the fruitfly *Drosphila melangoster,* a biologist measured the total time spent preening during a six-minute observation period for each of 20 flies. The following are the preening times (in seconds) for the 20 flies:

10, 16, 18, 19, 22, 24, 24, 25, 26, 29, 31, 32, 33, 34, 46, 48, 48, 52, 57, 76

1) Construct an ordered stemplot for these data.

2) **Fill in the blank.** Report the five number summary for the fruit fly data.

{ _____, _____, _____, _____, _____ }

3) **Fill in the blanks.** For the fruit fly experiment, name the

variable_____

type of variable_____

observational unit_____

sample size_____

4) **Circle the correct answer.** A random sample of USC students was selected for a study. Each person in the study was labeled as left handed, right handed, or ambidextrous. Which of the following could be a legitimate assignment of probabilities for this sample space?

$$0.2, 0.8, 0.1$$

$$0.3, 0.8, -0.1$$

$$0.2, 0.7, 0.1$$

$$0.1, 0.7, 0.1$$

5) $P\{A\} = 0.8$ $P\{A \cap B\} = 0.2$ **What is the probability of B given A?**

6) **Circle the correct answer. <u>TRUE</u> / <u>FALSE</u>**

Let Y be a continuous random variable. Then, $P\{Y < a\} = P\{Y \leq a\}$.

7) **Find $Z_{0.05}$.**

8) Let Y denote the number of female offspring the Asian Stochastic Beetle can have in her lifetime. A researcher reports the following probability distribution for Y:

Y	0	1	2
P{Y}	0.2	0.3	0.5

Find μ_Y

Find σ_Y

9) The Central Limit Theorem says that for any i.i.d. random sample, Y_1, Y_2, ..., Y_n where $E[Y_i] = \mu$ and $E[(Y_i-\mu)^2] = \sigma^2$, then as $n\rightarrow\infty$ the distribution of the sample mean is _____ with mean, _____, and variance, _____(note, I'm asking for variance here – not standard deviation).

Part II: Answer every part of the next three problems. Read each question carefully, and show your work for full credit.

1) (12 pts.) The West Nile Virus was first detected in the Western Hemisphere in 1999 and has since rapidly spread and become a serious health concern. 1% of people who have been infected with the West Nile Virus will develop a serious illness from the virus. Suppose 50 infected adults are chosen at random.

Find the probability that none of the 50 selected individuals develop a serious illness from the virus.

2) The heights of a certain population of corn plants follow a normal distribution with mean $\mu = 145$ centimeters and standard deviation $\sigma = 22$ centimeters.

a) (12 pts.) What percentage of corn plants from this population have heights between 130 and 155 centimeters?

b) (12 pts.) What is the 99th percentile for this distribution?

c) (12 pts.) If a random sample of 16 corn plants is chosen from this population, find the probability that their average height will be between 130 and 155 inches.

3) (12 pts.) A researcher investigated the effect of green light, in comparison to red light, on the growth rate of bean plants. The following is a QQplot for the heights (in) of plants from the soil to the first branching stem, two weeks after germination for the group grown under the green light condition.

The researcher would like to analyze this data using a statistical test that requires the assumption that the data come from a normal population. Using the QQplot, comment on whether this assumption is met and what led you to this conclusion.