Math 1040

EXAM #2

Name __KEY__
(print)

Total = 100 points
Please show all your work.

1. (20 pts) The data represents the number of vacation days used by a sample of 20 employees in a recent year. <u>Find the first, second, third quartile, and interquartile range.</u> <u>Identify any outliers.</u> Then, draw a box-and-whisker plot.

2 5 0 12 10 7 8 9 6 11
12 3 8 0 25 6 7 4 4 3

$0, 0, 2, 3, 3, 4, 4, 5, 6, 6, 7, 7, 8, 8, 9, 10, 11, 12, 12, 25$

$Q_1 = 3.5$ $Q_2 = 6.5$ $Q_3 = 9.5$

$IQR = 9.5 - 3.5 = 6$

$Q_1 - IQR \times 1.5 = -5.5$ $Q_3 + IQR \times 1.5 = 18.5$ $\Rightarrow$ 25 is the only outlier
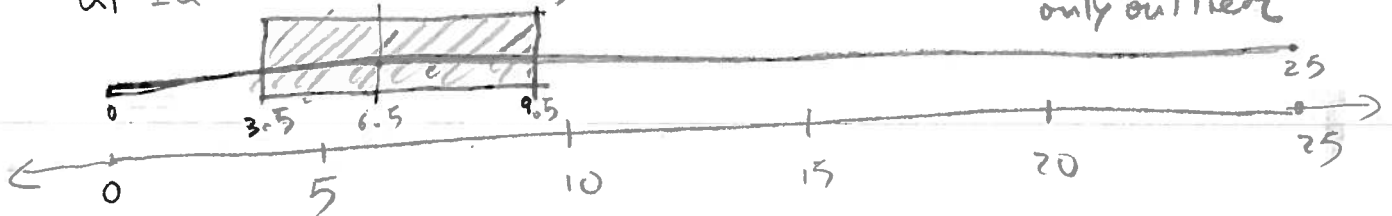
What percentile corresponds to 11 days of vacation?

$16/20 = 80th$ percentile

How many vacation days correspond to the 40-th percentile?

$.40 = \dfrac{n}{20}$ $\Rightarrow$ $n = 20 \times .4 = 8$ $\Rightarrow$ 6 days

2. (15 pts) The average airline pilot salary is \$114,000 with a standard deviation of \$29,000 (assume a bell-shaped distribution).
a) Compute the Z-score for salaries of \$67,000, \$125,000 and \$179,000 to determine which salary is unusual.
b) Using the empirical rule, find the percentiles corresponding to \$56,000 and \$143,000.

$$Z(67,000) = \frac{67000 - 114000}{29,000} = -1.62 \qquad Z(125,000) = \frac{125000 - 114000}{29000} = .38$$

$$Z(179,000) = \frac{179000 - 114000}{29} = 2.24$$

179,000 \$/year is the only unusual salary

$$Z(56,000) = \frac{56000 - 114000}{29} = -2 \longrightarrow 2.5\text{-th percentile}$$

$$Z(143,000) = \frac{143000 - 114000}{29} = 1 \Rightarrow 84\text{th percentile}$$

56,000   114

3. (20 pts)

	sociology major	non-sociology major
Males	150	12,350
Females	325	11,000

A student is selected at random. Find the following probabilities:
a) the student is a male or not sociology major

$$\frac{150 + 12350 + 11000}{150 + 325 + 12350 + 11000} = \frac{23500}{23825} = 98.6\%$$

b) the student is a female and sociology major

$$\frac{325}{23825} = 1.4\%$$

c) Given that the student is a male, what is the probability that he is sociology major?

$$\frac{150}{150 + 12350} = \frac{150}{12500} = 1.2\%$$

d) If we select 3 students at random (without replacement), what is the probability that all 3 students are men and [not] majoring in sociology?

$$\left(\frac{12350}{23825}\right)^3 = 13.8\%$$

4. (15 pts) According to the World Factbook website, as of July 2008, 67.1% of the U.S. population was 15-64 years old. Suppose that in a survey, 6 people are chosen at random from the population.

a) What is the probability that all 6 are 15-64 years old?

$$(.671)^6 \approx .09 = 9\%$$

b) What is the probability that at least one person is 15-64 years old?

$$1 - (1-.671)^6 = 1 - .329^6 \approx 99.9\%$$

$P(\text{not } 15-64) = 1 - .671$
$= .329$

$P(\geq 1 \text{ is } 15-64 \text{ yo})$
$= 1 - P(\text{all } 6 \text{ are not } 15-64)$

5. (20 pts) Five people are selected at random from a group of twenty women and fifteen men.

a) What is the probability that all five are women?
b) What is the probability that at least one of the five is a woman?
c) what is the probability that exactly three of the five is a woman?

a) $\dfrac{20C5}{35C5} = .0478 = 4.78\%$

b) $P(\geq 1 \text{ is a Woman}) = 1 - P(\text{all are men})$
$= 1 - \dfrac{15C5}{35C5} = .991 = 99.1\%$

c) $\dfrac{20C3 \times 15C2}{35C5} = .369 = 36.9\%$

6. (10 pts) The scholarships committee is considering 30 applicants for 5 awards ($3,500, $2,000, $1,000, $800, $500). How many different ways are possible to award these scholarships?

$$_{30}P_5 = 17,100,720$$