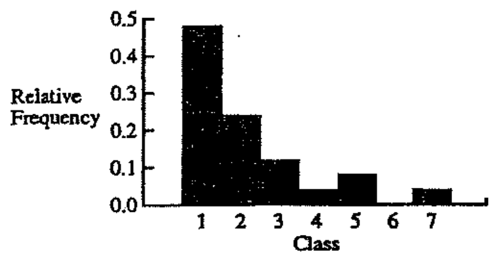
1.3 Similar to Exercise 1.2. We chose seven intervals of length 2.

Class Boundaries	Tally	Frequency	Relative Frequency
.005– 2.005	1111 1111 11	12	.48
2.005– 4.005	1111 1	6	.24
4.005– 6.005	111	3	.12
6.005– 8.005	1	1	.04
8.005–10.005	11	2	.08
10.005–12.005		0	.00
12.005–14.005	1	1	.04
		25	1.00



1.6 **a.** The modal category in this case is 2 (quarts of milk). About 36% (9 people) of the 25 sampled fell into this category.

b. The proportion of people who purchased 3, 4 and 5 quarts of milk are .2, .12 and .04 respectively. Therefore the answer is .2 +. 12 + .04 = .36.

c. Note that 8% of the people purchased 0 while 4% purchased 5. Thus a total of 8% + 4% = 12% purchased 0 or 5. Therefore 1-.12 = .88 (88%) of the people purchased between 1 and 4 quarts of milk.

1.9 **a.** $\sum_{i=1}^{n} c = c + c + c + \ldots + c$, where the sum involves n elements. Hence $\sum_{i=1}^{n} c = nc$.

b. $\sum_{i=1}^{n} cy_i = cy_1 + cy_2 + cy_3 + \ldots + cy_n = c(y_1 + y_2 + y_3 + \ldots + y_n) = c\sum_{i=1}^{n} y_i$.

c. $\sum_{i=1}^{n} (x_i + y_i) = x_1 + y_1 + x_2 + y_2 + x_3 + y_3 + \ldots + x_n + y_n$

$$= (x_1 + x_2 + x_3 + \ldots + x_n) + (y_1 + y_2 + y_3 + \ldots + y_n) = \sum_{i=1}^{n} x_i + \sum_{i=1}^{n} y_i.$$

Consider the numerator of s^2, which is $\sum_{i=1}^{n} (y_i - \overline{y})^2$.

$$\sum_{i=1}^{n} (y_i - \overline{y})^2 = \sum_{i=1}^{n} (y_i^2 - 2y_i + \overline{y})^2 = \sum_{i=1}^{n} y_i^2 - \sum_{i=1}^{n} 2y_i\overline{y} + \sum_{i=1}^{n} \overline{y}^2$$

$\overline{y}$ and $\overline{y}^2$ are constants with respect to the variable of summation (i). Hence

$$\sum_{i=1}^{n} (y_i - \overline{y})^2 = \sum_{i=1}^{n} y_i^2 - 2\overline{y}\sum_{i=1}^{n} y_i + n\overline{y}^2 = \sum_{i=1}^{n} y_i^2 - 2\overline{y}\,(n\overline{y}) + n\overline{y}^2 = \sum_{i=1}^{n} y_i^2 - n\overline{y}^2$$

with the second equality following from the fact that $\sum_{i=1}^{n} y_i = n\overline{y}$.

Thus, $s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} y_i^2 - n\overline{y}^2\right]$, or, since $\overline{y}^2 = \frac{1}{n^2}\left[\sum_{i=1}^{n} y_i\right]^2$,

$$s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} y_i^2 - \frac{1}{n}\left(\sum_{i=1}^{n} y_i\right)^2\right]$$

1.21 a. We assume that the set of 1521 games is the population. Then $\mu = 143$ and $\sigma = 26$. $169 = \mu + \sigma$, and by the empirical rule approximately 32% should be outside the interval $(\mu - \sigma, \mu + \sigma)$. Then half or approximately 16% should be greater than 169.

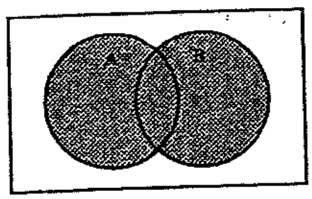
b. $117 = \mu - \sigma$ and half of approximately 68%, 34%, of the games should be between $\mu - \sigma$ and μ. $195 = \mu + 2\sigma$ and half of approximately 95%, or 47.5%, should be between μ and $\mu + 2\sigma$. Now, 34% + 47.5% = 81.5%, so that approximately 81.5% of the games should have ended with a total score between 117 and 195 points.

c. No. A score of 225 is greater than $\mu + 3\sigma$. Such a score is very unlikely according to the empirical rule..

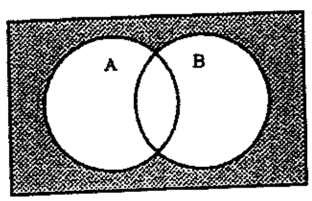
2.3 To verify $\overline{(A \cup B)} = \overline{A} \cap \overline{B}$, we can draw the following:

$\overline{(A \cup B)}$

$A \cup B \Rightarrow$

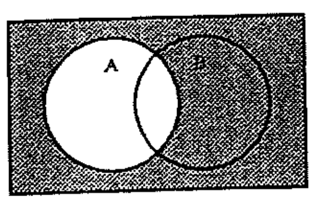


$\overline{A \cup B} \Rightarrow$

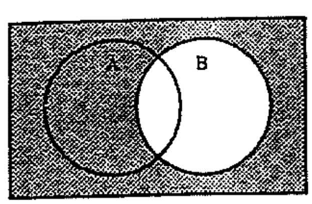


$\overline{A} \cap \overline{B}$

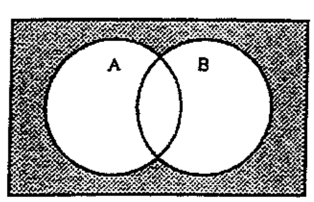
$\overline{A} \Rightarrow$



$\overline{B} \Rightarrow$

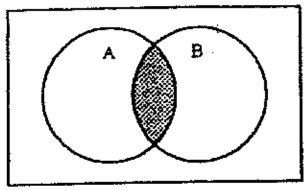


$\overline{A} \cap \overline{B} \Rightarrow$

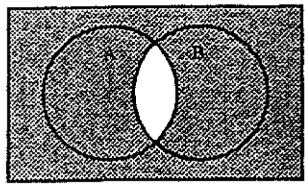


$\overline{A \cap B}$

$A \cap B \Rightarrow$



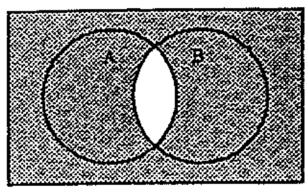
$\overline{A \cap B} \Rightarrow$



$\overline{A} \cup \overline{B}$

$\overline{A}$, $\overline{B}$ shown above

$\overline{A} \cup \overline{B} \Rightarrow$



2.4

A:	(1, 2)	(2, 2)	(3, 2)	(4, 2)	(5, 2)	(6, 2)	(1, 4)	(2, 4)	(3, 4)
	(4, 4)	(5, 4)	(6, 4)	(1, 6)	(2, 6)	(3, 6)	(4, 6)	(5, 6)	(6, 6)
$\overline{C}$:	(2, 2)	(2, 4)	(2, 6)	(4, 2)	(4, 4)	(4, 6)	(6, 2)	(6, 4)	(6, 6)
$A \cap B$:	(2, 2)	(4, 2)	(6, 2)	(2, 4)	(4, 4)	(6, 4)	(2, 6)	(4, 6)	(6, 6)
$A \cap \overline{B}$:	(1, 2)	(3, 2)	(5, 2)	(1, 4)	(3, 4)	(5, 4)	(1, 6)	(3, 6)	(5, 6)
$\overline{A} \cup$ B:	all pairs except								
	(1, 2)	(1, 4)	(1,6)	(3, 2)	(3, 4)	(3, 6)	(5, 2)	(5,4)	(5, 6)
$\overline{A} \cap C$:	(1, 1)	(2, 1)	(3, 1)	(4, 1)	(5, 1)	(6, 1)	(1, 3)	(2, 3)	(3, 3)
	(4, 3)	(5, 3)	(6, 3)	(1, 5)	(2, 5)	(3, 5)	(4, 5)	(5, 5)	(6, 5)

Note that $\overline{A} \cap C = \overline{A}$.

2.8 a. The sample space consists of the four possible blood phenotypes. That is,

$$S = \{A, B, AB, O\}.$$

b. The probabilities that a single caucasian has a given blood type may be assigned as follows.

$$P(\{A\}) = 0.41,\ P(\{B\}) = 0.10,\ P(\{AB\}) = 0.04,\ P(\{O\}) = 0.45$$

c. Since the events $\{A\}$ and $\{AB\}$ are mutually exclusive

$$P(A \text{ or } B) = P(A) + P(AB) = 0.41 + 0.04 = 0.45$$