The data (in dollars) for second quarter earnings per share (EPS) for major banks in the Northwest are tabulated below.

<table>
<thead>
<tr>
<th>Name</th>
<th>EPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank of New York</td>
<td>2.5</td>
</tr>
<tr>
<td>BankBoston</td>
<td>4.3</td>
</tr>
<tr>
<td>Banker’s Trust/NY</td>
<td>7.5</td>
</tr>
<tr>
<td>Chase Manhattan</td>
<td>7.5</td>
</tr>
<tr>
<td>Citicorp</td>
<td>8.0</td>
</tr>
<tr>
<td>Fleet</td>
<td>4.3</td>
</tr>
<tr>
<td>MBNA</td>
<td>1.5</td>
</tr>
<tr>
<td>Mellon</td>
<td>2.7</td>
</tr>
<tr>
<td>Morgan JP</td>
<td>7.2</td>
</tr>
<tr>
<td>PNC Bank</td>
<td>3.1</td>
</tr>
<tr>
<td>Republic</td>
<td>7.4</td>
</tr>
<tr>
<td>State Street</td>
<td>2.0</td>
</tr>
<tr>
<td>Summit</td>
<td>3.2</td>
</tr>
</tbody>
</table>

a. (2 pts.) Construct a stem-and-leaf display for the data.

Solution. The stem-and-leaf display has the form:

```
1 | 5
2 | 0 5 7
3 | 1 2
4 | 3 3
5 |
6 |
7 | 2455
8 | 0
```
b. (5=2+2+1 pts.) Find $Q_L$, $Q_U$ and $m$ (the lower quartile, upper quartile and median).  
Answer:

$m=4.3 \quad Q_L=(2.5+2.7)/2 =2.6 \quad Q_U= (7.4+7.5)/2 = 7.45$

c. (2 pts.) Give the 5-number summary of the data (min, $Q_L$, $m$, $Q_U$, max).
Answer:

$1.5 \quad 2.6 \quad 4.3 \quad 7.45 \quad 8.0$

d. (4 pts.) Find the IQR, $Q_L-1.5$ IQR, $Q_U+1.5$ IQR. Are there any outliers? Explain.
Answer:

IQR = 7.45-2.6 = 4.85 \quad Q_L-1.5 \ IQR = -4.675 \quad Q_U + 1.5 \ IQR = 14.725

Since there are no entries to the left of -4.675 and to the right of 14.725, there are no outliers

e. (4 pts.) Find the proportion of the data falling into the interval $(\bar{x} - 1.1s, \bar{x} + 1.1s)$. To save your time I give the values $\bar{x}=4.7$, $s=2.4$.

Answer:

The interval $(\bar{x} - 1.1s, \bar{x} + 1.1s)$ has the form $(2.06, 7.34)$. The proportion of data that falls into the interval is $7/13 = 0.53$

f. (4 pts.) What does Chebyshev rule say about the proportion in d.? Is your proportion found in d. in accordance with the Chebyshev rule? Explain.

Answer:
Chebyshev says that this should be greater than \(1 - 1/1.1^2 = 0.17\).

The proportion found is in accordance with Chebyshev, because \(0.53 > 0.17\).

2. a. (4 pts.) Find \(\bar{x}\) and \(s_x\) for the following (artificial) data: \(x_1=1\), \(x_2=4\), \(x_3=7\), \(x_4=-2\).

   Answer:

   \[
   \bar{x} = 2.5, \quad s_x = 3.87.
   \]

b. (2 pts.) Consider now the data \(y_1=1001\), \(y_2=1004\), \(y_3=1007\), \(y_4=998\). What is the formula that relates \(X\) and \(Y\)?

   Answer:

   \[
   y = 1000 + x.
   \]

c. (5=2+3 pts.) Can you find without calculation \(\bar{y}\) and \(s_y\) using calculations in a.? What is the rule you have used? Answer:

   Yes, we can:

   \[
   \bar{y} = 1000 + x, \quad s_y = 3.87.
   \]

The rule is: If we have data \(x_1...x_n\) and \(y_1...y_n\), where \(y = x + a\), then \(\bar{y} = \bar{x} + a\), and \(s_y = s_x\).
3. As a part of a student project for the 2005 Science Fair in Orange, Massachusetts, 28 horses were made to listen to Mozart and heavy-metal music. The results were as follows: 11 of 28 horses exhibited some head movement when Mozart was played; 8 exhibited some head movement when the heavy metal was played and 5 moved their heads when both were played.

Let us introduce events: \( A = \{ \text{a randomly chosen horse exhibited some head movement when Mozart was played} \} \); \( B = \{ \text{a randomly chosen horse exhibited some head movement when heavy metal was played} \} \)

a. (4 =2+2 pts.) What are probabilities of \( A \), \( B \) and the intersection of them? Consider the event \( D \): a randomly chosen horse was exhibited head movement to Mozart or to heavy metal or to both? Express \( D \) through \( A \) and \( B \) and find its probability.

Answer:

\[
P(A) = \frac{11}{28}, \quad P(B) = \frac{8}{28}, \quad P(A \cap B) = \frac{5}{28}, \quad D = A \cup B, \quad P(D) = 0.5.
\]

b. (pts.) (4=2+1+1) Express in words the event \( A \cap B^c \), shade it on the Venn diagram and find its probability. Answer:

\( A \cap B^c = \{ \text{a randomly chosen horse reacted on Mozart but didn't react on heavy metal} \} \)

\[
P(A \cap B^c) = \frac{11}{28} - \frac{5}{28} = \frac{6}{28}.
\]