Section 2.4: Survey Problems

- **Cardinal Number Formula:** \( n(A \cup B) = n(A) + n(B) - n(A \cap B) \)

**Example 1:** If \( n(A) = 15, n(B) = 12, \) and \( n(A \cup B) = 25 \), find \( n(A \cap B) \).

**Example 2:** Bob writes and produces albums for musicians. Last year, he worked on 10 such products.

- He wrote and produced 2 projects
- He wrote a total of 5 projects
- He produced a total of 7 projects

(a) Fill in the Venn Diagram **COMPLETELY** with the number of projects in each section using the above information.

(b) How many projects did he write but not produce?

(c) How many projects did he produce but not write?
Example 3: A construction crew is made up of individuals who have been trained to operate specific pieces of heavy equipment. The equipment and the number of people with each skill are listed below:

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Backhoe (H)</td>
<td>17</td>
</tr>
<tr>
<td>Bulldozer (D)</td>
<td>17</td>
</tr>
<tr>
<td>Crane (C)</td>
<td>15</td>
</tr>
<tr>
<td>Backhoe and bulldozer</td>
<td>5</td>
</tr>
<tr>
<td>Backhoe and crane</td>
<td>8</td>
</tr>
<tr>
<td>Bulldozer and crane</td>
<td>7</td>
</tr>
<tr>
<td>All three</td>
<td>3</td>
</tr>
</tbody>
</table>

If every member of the crew can operate at least one of the machines, how many people are in the crew?
Example 4: Ruth was planning a study on viewer response to certain aspects of the movies \textit{The Sixth Sense}, \textit{Ghost}, and \textit{Heaven Can Wait}. Upon surveying a group of 55 students, she determined the following:

- 17 had seen \textit{The Sixth Sense} (S)
- 17 had seen \textit{Ghost} (G)
- 23 had seen \textit{Heaven Can Wait} (H)
- 6 had seen \textit{The Sixth Sense} and \textit{Ghost}
- 8 had seen \textit{The Sixth Sense} and \textit{Heaven Can Wait}
- 10 had seen \textit{Ghost} and \textit{Heaven Can Wait}
- 2 had seen all three of these movies.

(a) Fill in the Venn Diagram \textbf{COMPLETELY} with the number of students in each section using the above information.

(b) How many students had seen exactly two of these movies?

(c) How many students had seen exactly one of these movies?

(d) How many students had seen none of these movies?

(e) How many students had seen \textit{The Sixth Sense} but none of the others?