Class Exercise 5 - Solutions

1. **Crime Shows and Questionable Life Choices**

   A group of students in a Probability and Statistics class were surveyed about the crime shows they binge-watch on Netflix instead of studying. Let the sample space, S, be

   $$S = \{\text{Breaking Bad, Narcos, Money Heist, Ozark, Sherlock, Peaky Blinders, Mindhunter, Dexter, The Wire}\}$$

   Consider the following events:

   $A = \{\text{Breaking Bad, Narcos, Ozark, The Wire}\}$ *Shows centered around drug empires*
   $B = \{\text{Money Heist, Peaky Blinders, Narcos}\}$ *Shows involving organized crime gangs*
   $C = \{\text{Sherlock, Mindhunter, The Wire}\}$ *Shows focused on detectives/investigators*
   $D = \{\text{Dexter, Breaking Bad, Ozark}\}$ *Shows with morally ambiguous protagonists*

   Compute the following

   a. The set of shows that are centred around drug empires and involve organized crime gangs.

      Solution

      Want

      $$A \cap B = \{\text{Narcos}\}$$

   b. The set of shows that are about drug empires and also focus on detectives or investigators.

      Solution

      Want

      $$A \cap C = \{\text{The Wire}\}$$

   c. The set of shows that either involve organized crime gangs or focus on detectives/investigators (or both).

      Solution

      Want

      $$B \cup C = \{\text{Money Heist, Peaky Blinders, Narcos, Sherlock, Mindhunter, The Wire}\}$$

d. The set of shows that are not centred around drug empires.

Solution

Want

$$A' = \{\text{Money Heist, Peaky Blinders, Sherlock, Mindhunter, Dexter}\}$$

e. The set of shows that neither involve organized crime gangs nor focus on detectives/investigators.

Solution

Want $(B \cup C)'$

$$B \cup C = \{\text{Money Heist, Peaky Blinders, Narcos, Sherlock, Mindhunter, The Wire}\}$$
$$\therefore \quad (B \cup C)' = \{\text{Breaking Bad, Ozark, Dexter}\}$$

f. The set of shows that do not involve organized crime gangs and do not focus on detectives/investigators.

Solution

Want $B' \cap C'$

$$\begin{aligned} B' \cap C' &= (B \cup C)' \\ &= \{\text{Breaking Bad, Ozark, Dexter}\} \end{aligned}$$

g. The set of shows that are either centred around drug empires and feature morally ambiguous protagonists, or focus on detectives/investigators and feature morally ambiguous protagonists.

Solution

Want $(A \cap D) \cup (C \cap D)$

$$\begin{aligned} A \cap D &= \{\text{Breaking Bad, Ozark}\} \\ C \cap D &= \emptyset \\ (A \cap D) \cup (C \cap D) &= \{\text{Breaking Bad, Ozark}\} \end{aligned}$$

h. The set of shows that feature morally ambiguous protagonists but are neither centred around drug empires nor involve organized crime gangs.

Solution

Want $(A \cup B)' \cap D$

$$\begin{aligned} A \cup B &= \{\text{Breaking Bad, Narcos, Ozark, Money Heist, Peaky Blinders, The Wire}\} \\ (A \cup B)' &= \{\text{Sherlock, Mindhunter, Dexter}\} \\ (A \cup B)' \cap D &= \{\text{Dexter}\} \end{aligned}$$