Exercise for March 31, 2007

**May 2003 Course 1 Examination, Problem No. 1, also Study Note P-09-05 Problem No. 1**

A survey of a group’s viewing habits over the last year revealed the following information:

(i) 28% watched gymnastics
(ii) 29% watched baseball
(iii) 19% watched soccer
(iv) 14% watched gymnastics and baseball
(v) 12% watched baseball and soccer
(vi) 10% watched gymnastics and soccer
(vii) 8% watched all three sports.

Calculate the percentage of the group that watched none of the three sports during the last year.

A. 24  B. 36  C. 41  D. 52  E. 60

**Solution.**

Treat the groups’ preferences as events: $G$ – watching gymnastics, $B$ – watching baseball, $F$ – watching soccer ($F$ for “football”, as the rest of the world calls it, because we use $S$ for the probability space). We have the following probabilities:

- $\Pr(G) = 0.28$,
- $\Pr(B) = 0.29$,
- $\Pr(F) = 0.19$,
- $\Pr(G \cap B) = 0.14$,
- $\Pr(B \cap F) = 0.12$,
- $\Pr(G \cap F) = 0.10$,
- $\Pr(G \cap B \cap F) = 0.08$.

Therefore, the non-overlapping pieces of these sets have the probabilities shown in the figure below.
We are interested in the area outside of the ovals, i.e.,
\[ 1 - 0.12 - 0.02 - 0.06 - 0.08 - 0.05 - 0.04 - 0.11 = 0.52. \]
You can also formally calculate it as:
\[
\Pr\left(\left( G \cup B \cup F \right)^c \right) = 1 - \Pr\left( G \cup B \cup F \right) = 1 - \Pr(G) - \Pr(B) - \Pr(F) + \\
+ \Pr(G \cap B) + \Pr(G \cap F) + \Pr(B \cap F) - \Pr(G \cap B \cap F) = \\
= 1 - 0.28 - 0.29 - 0.19 + 0.14 + 0.12 + 0.10 - 0.08 = 0.52.
\]
Answer D.