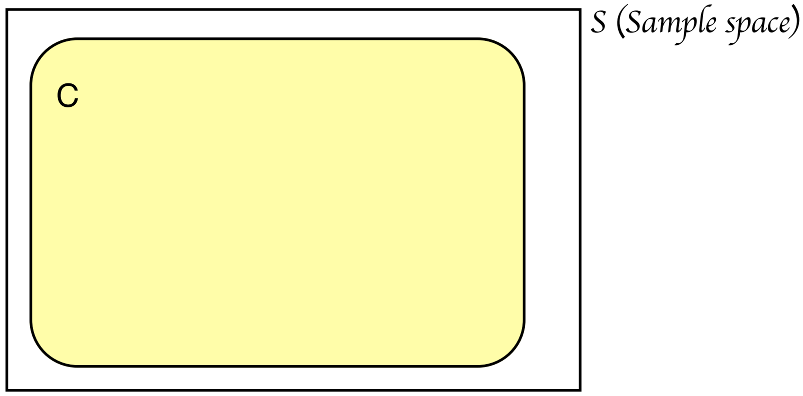
EX: Draw all possible representative Venn diagrams consistent with the following information about events *A*, *B*, and *C*: (use areas approximating probabilities)

$P(A) = 0.225$ $P(B) = 0.4$ $P(C) = 0.9$

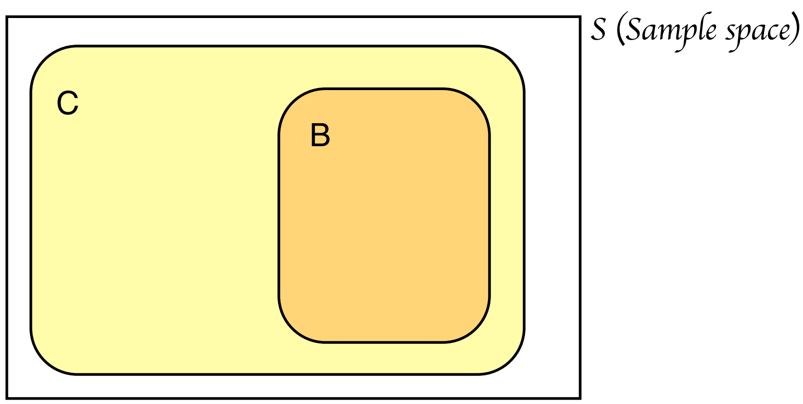
$P(A \cap B') = 0.125$ $P(B \cap C) = 0.4$

SOL'N: We start our Venn diagram by drawing the most probable event, *C*:



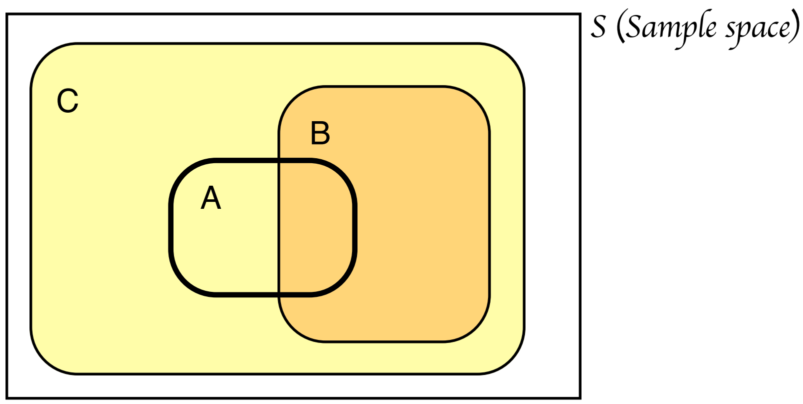
Total area of the diagram = total probability of sample space = 1. The area for event C = P(C) = 0.9.

We observe that P(B) = P(B ∩ C) = 0.4. This implies that event B lies entirely inside event C. (Note: strictly speaking, event B might contain outcomes of zero probability that lie outside C. Thus, we are ignoring such outcomes. This is not a serious problem since the probability of these outcomes is zero.)



Given $P(A) = 0.225$ and $P(A \cap B') = 0.125$, we apply the law of total probability that says $P(A \cap B) + P(A \cap B') = P(A)$ to conclude that $P(A \cap B) = 0.1$.

What we still lack is information about the intersection of A and C. It is possible that A lies entirely in C. So one possible representative diagram is as follows:



We know that A intersects B, but might the rest of A lie outside C? Or does A have to intersect the part of C outside of B? The probability of being in the part of A lying outside of B is $P(A \cap B') = 0.125$. But $P(C') = 1 - P(C) = 0.1$. Thus, there is too little room outside of C to fit all of A not lying in B. The minimum value for $P(A \cap B')$ is 0.025 as shown in the other representative diagram: