Consider a company manufacturing various types of integrated circuits (IC). Let \( S \) be the sample space of all possible IC types that any given product manufactured by this company can be. Let’s define the following events:

- \( A \): The IC uses 32-bit technology
- \( B \): The IC uses 64-bit technology
- \( C \): The IC is a SDRAM (an older type of memory chip)
- \( D \): The IC is a RDRAM (a newer type of memory chip)
- \( E \): The IC is manufactured at the company’s plant in Taiwan

We are also given the following information:

- All chips manufactured by this company use either 32-bit or 64-bit technology.
- \( P(A) = 0.4, P(C) = 0.1, P(D) = 0.5, P(E) = 0.45, P(A \cap C) = 0.1, P(A \cap D) = 0.2, P(A \cap E) = 0.15, P(D \cap E) = 0.25 \) and \( P(A \cap D \cap E) = 0.05 \).

1. Prove that the company does not produce any 64-bit SDRAM chips. \textit{Hint: Show that the probability of such a chip is 0.}

2. Draw the Venn diagram showing all events. \textit{Note: Show all possible intersections unless you are sure two events don’t intersect. For instance, a chip can’t be a SDRAM and a RDRAM at the same time.}

3. Compute \( P(B \cap C \cap D) \).

4. Compute \( P(D \cup E \cup A) \).

5. Compute \( P(B \cap D' \cap E') \). \textit{Hint: Use the Venn diagram.}
5) a) 64-bit SDRAM chip \( \Rightarrow \) B n C

We want to show \( P(B \cap C) = 0 \)

Since all chips are either 32-bit (A) or 64-bit (B), events A and B form a partition of S. Then, using the rule of total probability:

\[
P(C) = P(C \cap A) + P(B \cap C)
\]

\[
0.1 = 0.1 + P(B \cap C) \Rightarrow P(B \cap C) = 0.
\]

b) Notice that:

- \( A, B \) form partition
- \( C \cap B = \emptyset \) as shown in part a
- \( C \cap D = \emptyset \) since a chip can't both be a SDRAM and a RDRAM at the same time

c) \( B \cap C \cap D = (B \cap C) \cap D = \emptyset \cap D = \emptyset \)

so \( P(B \cap C \cap D) = 0 \)

d) \( P(D \cup E \cup A) = P(D) + P(E) + P(A) - P(D \cap E) - P(D \cap A) - P(E \cap A) + P(D \cap E \cap A) \)

\[
= 0.5 + 0.45 + 0.4 - 0.25 - 0.2 - 0.15 + 0.1
\]

\[
= 0.8
\]

e) From Venn diagram, notice

\( B \cap D' \cap E = (A \cup D \cup E)' \)

so \( P(B \cap D' \cap E) = 1 - P(A \cup D \cup E) \)

\[
= 1 - P(D \cup E \cup A) = 1 - 0.8 = 0.2
\]

Without Venn Diagram (harder)

\( (B \cap D' \cap E)' = B' \cup (D' \cap E)' \)

\( = A \cup (D')' \cup (E)' \)

\( = A \cup D \cup E \)