Consider a company manufacturing various types of integrated circuits (IC). Let $\mathcal{S}$ be the sample space of all possible IC types that any given product manufactured by this company can be. Lets 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. *Hint: Show that the probability of such a chip is* 0*.*
2. Draw the Venn diagram showing all events. *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 $P(B \cap D' \cap E')$. *Hint: Use the Venn diagram.*

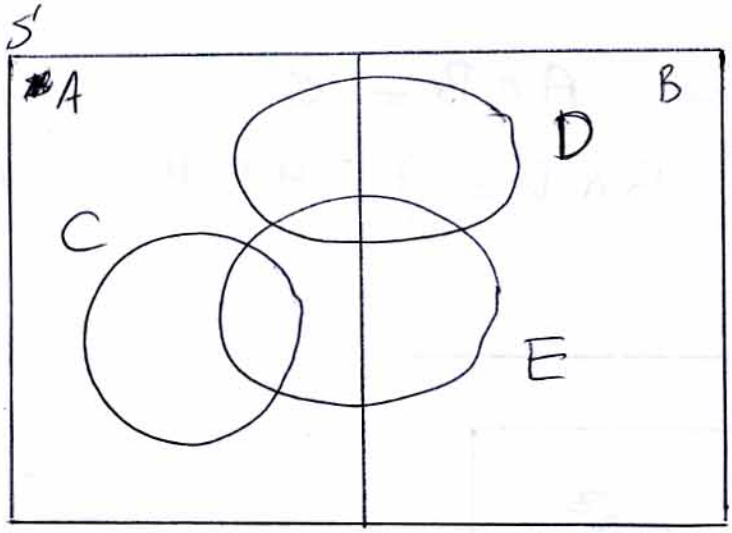
(5) a) 64-bit SDRAM chip $\Rightarrow B \cap C$

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:

$$P(C) = P(C \cap A) + P(B \cap C)$$

$$0.1 = 0.1 + P(B \cap C) \Rightarrow \underline{P(B \cap C) = 0}.$$

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

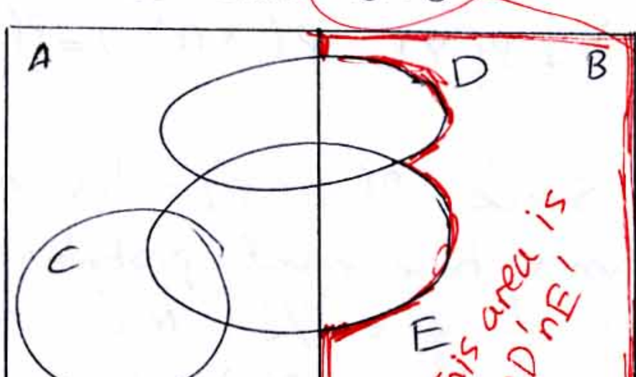
c) $B \cap C \cap D = (B \cap C) \cap D = \emptyset \cap D = \emptyset$

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

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

$= 0.5 + 0.45 + 0.4 - 0.25 - 0.2 - 0.15 + 0.$

$= 0.8$

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)

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

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

$= A \cup D \cup E$