STAT 3631/5631 Homework

Applied Statistics and Probability for Engineers
Montgomery and Runger

Solutions to Chapter 2: 1, 2, 3, 6, 9, 16, 19, 21, 23, 26, 33, 35, 38, 39, 41, 43, 45.

2-1. Let "a", "b" denote a part above, below the specification

$S = \{aaa, aab, aba, abb, baa, bab, bba, bbb\}$

2-2. Let "e" denote a bit in error

Let "o" denote a bit not in error ("o" denotes okay)

$$S = \begin{Bmatrix} eeee, eoee, oeee, ooee, \\ eeeo, eoeo, oeeo, ooeo, \\ eeoe, eooe, oeoe, oooe, \\ eeoo, eooo, oeoo, oooo \end{Bmatrix}$$

2-3. Let "a" denote an acceptable power supply

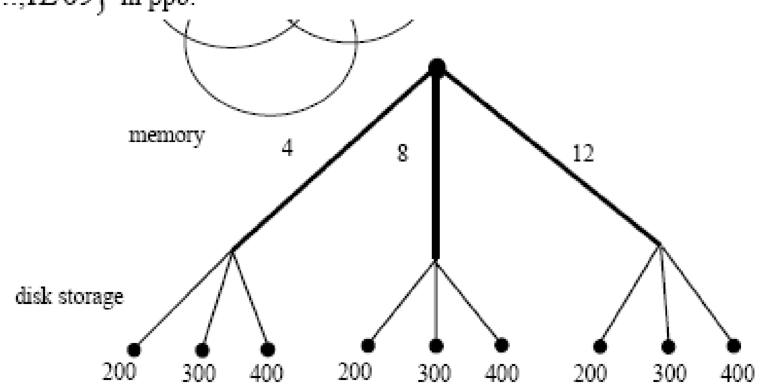
Let "f" ,"m","c" denote a supply with a functional, minor, or cosmetic error, respectively.

$S = \{a, f, m, c\}$

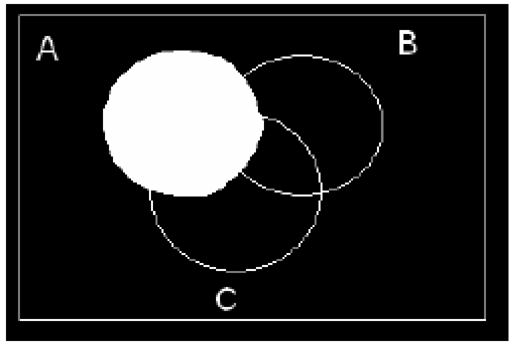
2-6. A vector with three components can describe the three digits of the ammeter. Each digit can be 0,1,2,...,9. Then S is a sample space of 1000 possible three digit integers, $S = \{000, 001, \ldots, 999\}$

2-9. $S = \{0, 1, 2, \ldots, 1E09\}$ in ppb.

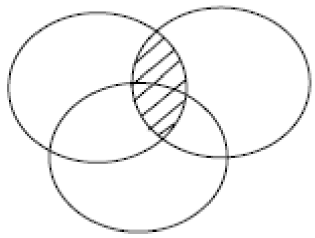
2-16.

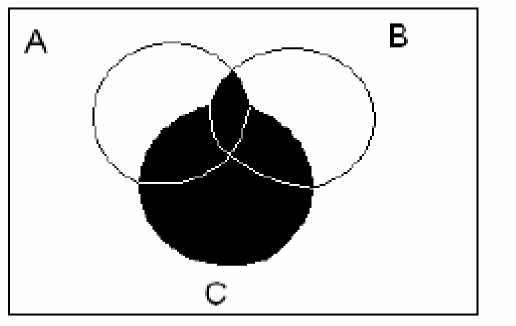


2-19 a)

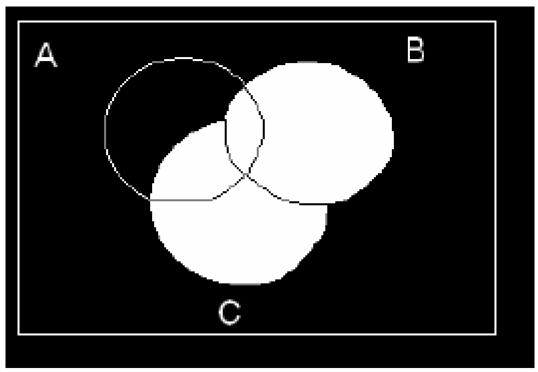


b)

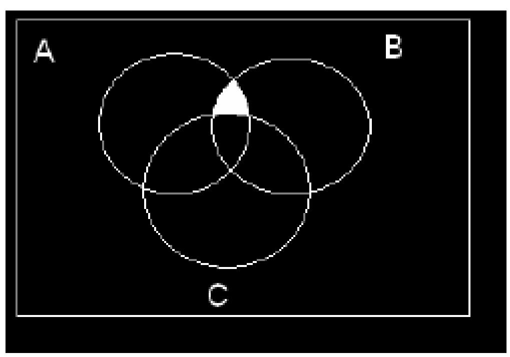




d)



e)



2-21. a) S = nonnegative integers from 0 to the largest integer that can be displayed by the scale.
Let X represent weight.
A is the event that $X > 11$ B is the event that $X \leq 15$ C is the event that $8 \leq X < 12$
S = {0, 1, 2, 3, …}

b) S

c) $11 < X \leq 15$ or {12, 13, 14, 15}

d) $X \leq 11$ or {0, 1, 2, …, 11}

e) S

f) $A \cup C$ would contain the values of X such that: $X \geq 8$
Thus $(A \cup C)'$ would contain the values of X such that: $X < 8$ or {0, 1, 2, …, 7}

g) $\varnothing$

h) B' would contain the values of X such that $X > 15$. Therefore, $B' \cap C$ would be the empty set. They have no outcomes in common or $\varnothing$

i) $B \cap C$ is the event $8 \leq X < 12$. Therefore, $A \cup (B \cap C)$ is the event $X \geq 8$ or {8, 9, 10, …}

2-23. Let "d" denoted a distorted bit and let "o" denote a bit that is not distorted.

a) $S = \begin{Bmatrix} \text{dddd, dodd, oddd, oodd,} \\ \text{dddo, dodo, oddo, oodo,} \\ \text{ddod, dood, odod, oood,} \\ \text{ddoo, dooo, odoo, oooo} \end{Bmatrix}$

b) No, for example $A_1 \cap A_2 = \{\text{dddd, dddo, ddod, ddoo}\}$

c) $A_1 = \begin{Bmatrix} dddd, dodd, \\ dddo, dodo \\ ddod, dood \\ ddoo, dooo \end{Bmatrix}$

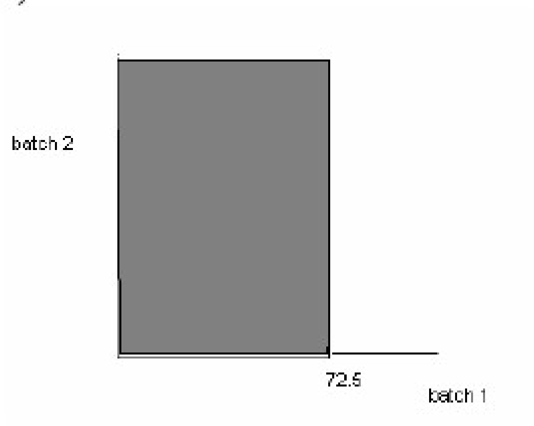
d) $A_1' = \begin{Bmatrix} oddd, oodd, \\ oddo, oodo, \\ odod, oood, \\ odoo, oooo \end{Bmatrix}$

e) $A_1 \cap A_2 \cap A_3 \cap A_4 = \{dddd\}$

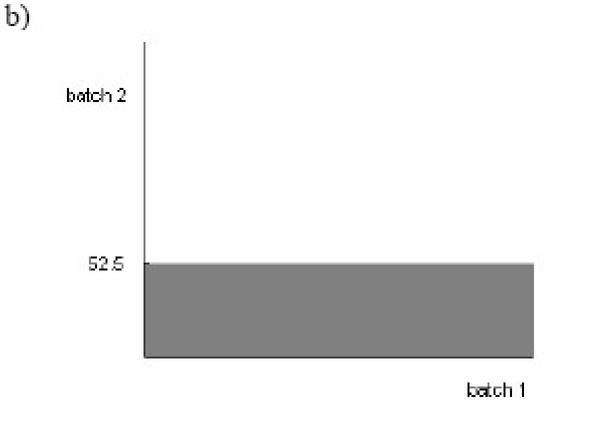
f) $(A_1 \cap A_2) \cup (A_3 \cap A_4) = \{dddd, dodd, dddo, oddd, ddod, oodd, ddoo\}$

2-26. $A \cap B = 70$, $A' = 14$, $A \cup B = 95$

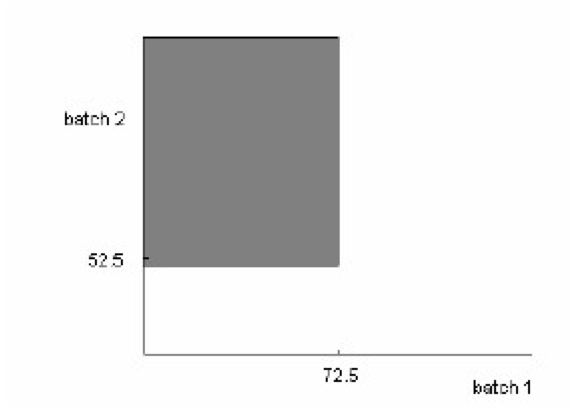
2-33 a)



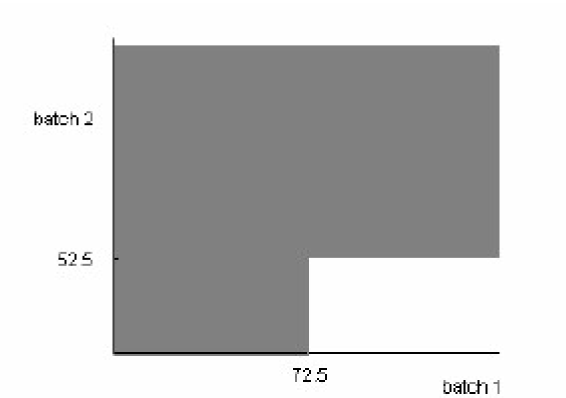
b)



c)



d)



2-35. From the multiplication rule, the answer is $5 \times 3 \times 4 \times 2 = 120$

2-38. From equation 2-1, the answer is 10! = 3,628,800

2-39. From the multiplication rule and equation 2-1, the answer is 5!5! = 14,400

2-41. a) From equation 2-4, the number of samples of size five is $\binom{140}{5} = \frac{140!}{5!135!} = 416,965,528$

b) There are 10 ways of selecting one nonconforming chip and there are $\binom{130}{4} = \frac{130!}{4!126!} = 11,358,880$ ways of selecting four conforming chips. Therefore, the number of samples that contain exactly one nonconforming chip is $10 \times \binom{130}{4} = 113,588,800$

c) The number of samples that contain at least one nonconforming chip is the total number of samples $\binom{140}{5}$ minus the number of samples that contain no nonconforming chips $\binom{130}{5}$.

That is $\binom{140}{5}$ - $\binom{130}{5} = \frac{140!}{5!135!} - \frac{130!}{5!125!} = 130,721,752$

2-43. a) $\dfrac{7!}{2!5!} = 21$ sequences are possible.

b) $\dfrac{7!}{1!1!1!1!1!2!} = 2520$ sequences are possible.

c) $6! = 720$ sequences are possible.

2-45. a) From the multiplication rule, $10^3 = 1000$ prefixes are possible

b) From the multiplication rule, $8 \times 2 \times 10 = 160$ are possible

c) Every arrangement of three digits selected from the 10 digits results in a possible prefix.

$P_3^{10} = \dfrac{10!}{7!} = 720$ prefixes are possible.