CHAPTER 2

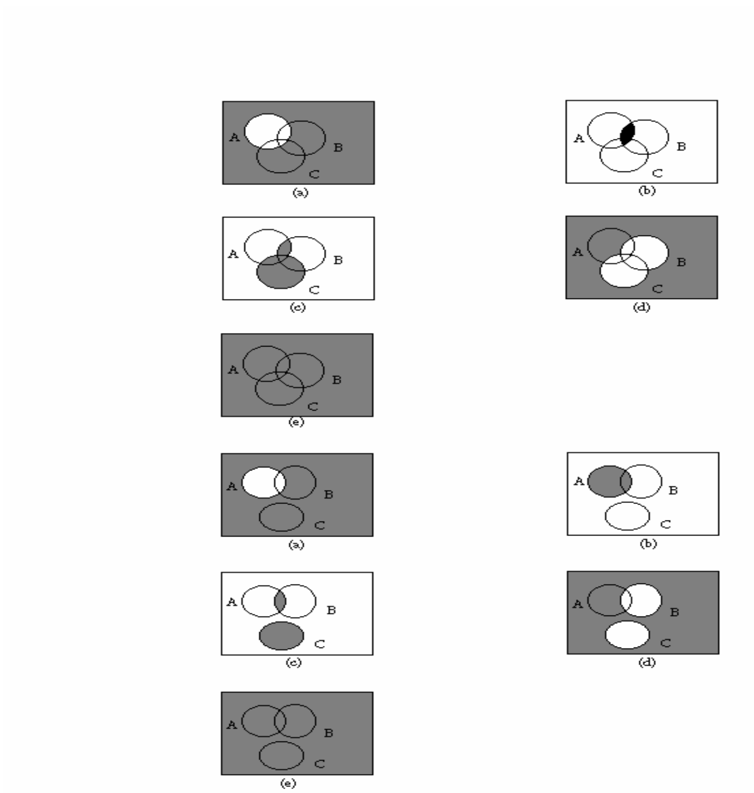
Section 2-1

2-2. Let "e" denote a bit in error
Let "o" denote a bit not in error ("o" denotes okay)

$$S = \left\{ \begin{array}{l} eeee, eoee, oeee, ooee, \\ eeeo, eoeo, oeeo, ooeo, \\ eeoe, eooe, eoeo, oooe, \\ eeoo, eooo, oeoo, oooe \end{array} \right\}$$

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, $S = \{000, 001, \ldots, 999\}$

2-19. & 2-20.



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

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

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

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

Section 2-2

2-34. All outcomes are equally likely

a) $P(A) = 2/5$

b) $P(B) = 3/5$

c) $P(A') = 3/5$

d) $P(A \cup B) = 1$

e) $P(A \cap B) = P(\emptyset) = 0$

2-37. a) $S = \{1,2,3,4,5,6,7,8\}$

b) 2/8

c) 6/8

2-41. a) 0.25

b) 0.75

Section 2-3

2-50. a) $P(A \cup B \cup C) = P(A) + P(B) + P(C)$, because the events are mutually exclusive. Therefore,
$P(A \cup B \cup C) = 0.2+0.3+0.4 = 0.9$
b) $P(A \cap B \cap C) = 0$, because $A \cap B \cap C = \emptyset$
c) $P(A \cap B) = 0$, because $A \cap B = \emptyset$
d) $P((A \cup B) \cap C) = 0$, because $(A \cup B) \cap C = (A \cap C) \cup (B \cap C) = \emptyset$

2-52. a) 70/100 = 0.70
b) (79+86-70)/100 = 0.95
c) No, $P(A \cap B) \neq 0$

2-56. a) (207+350+357-201-204-345+200)/370 = 0.9838
b) 366/370 = 0.989
c) 145/370 = 0.392
d) 149/370 = 0.403

Section 2-4

2-58.1. a) 0.82 b) 0.90 c) 8/9 = 0.889
d) 80/82 = 0.9756

2-62. a) 20/100
b) 19/99
c) If the chips were replaced, the probability in part b. would be 20/100

Section 2-5

2-70. a) $P(A \cap B) = P(A|B)P(B) = (0.4)(0.5) = 0.20$

b) $P(A' \cap B) = P(A'|B)P(B) = (0.6)(0.5) = 0.30$

2-74. a) P(A) = 0.03
b) P(A') = 0.97
c) P(B|A) = 0.40
d) P(B|A') = 0.05
e) $P(A \cap B) = P(B|A)P(A) = (0.40)(0.03) = 0.012$
f) $P(A \cap B') = P(B'|A)P(A) = (0.60)(0.03) = 0.018$
g) $P(B) = P(B|A)P(A) + P(B|A')P(A') = (0.40)(0.03) + (0.05)(0.97) = 0.0605$

2-76. Let B denote the event that a glass breaks.
Let L denote the event that large packaging is used.
P(B)= P(B|L)P(L) + P(B|L')P(L')
= 0.01(0.60) + 0.02(0.40) = 0.014

Section 2-6

2-84. $P(A \cap B) = 80/100$, P(A) = 82/100, P(B) = 90/100.
Then, $P(A \cap B) \neq$ P(A)P(B), so A and B are not independent.

2-87. It is useful to work one of these exercises with care to illustrate the laws of probability. Let H_i denote the event that the ith sample contains high levels of contamination.

a) $P(H_1' \cap H_2' \cap H_3' \cap H_4' \cap H_5') = P(H_1')P(H_2')P(H_3')P(H_4')P(H_5')$

by independence. Also, $P(H_i') = 0.9$. Therefore, the answer is $0.9^5 = 0.59$

b) $A_1 = (H_1 \cap H_2' \cap H_3' \cap H_4' \cap H_5')$

$A_2 = (H_1' \cap H_2 \cap H_3' \cap H_4' \cap H_5')$

$A_3 = (H_1' \cap H_2' \cap H_3 \cap H_4' \cap H_5')$

$A_4 = (H_1' \cap H_2' \cap H_3' \cap H_4 \cap H_5')$

$A_5 = (H_1' \cap H_2' \cap H_3' \cap H_4' \cap H_5)$

The requested probability is the probability of the union $A_1 \cup A_2 \cup A_3 \cup A_4 \cup A_5$ and these events are mutually exclusive. Also, by independence $P(A_i) = 0.9^4(0.1) = 0.0656$. Therefore, the answer is 5(0.0656) = 0.328.

c) Let B denote the event that no sample contains high levels of contamination. The requested probability is P(B') = 1 - P(B). From part (a), P(B') = 1 - 0.59 = 0.41.

2-90. Let A denote the upper devices function. Let B denote the lower devices function.
P(A) = (0.9)(0.8)(0.7) = 0.504
P(B) = (0.95)(0.95)(0.95) = 0.8574
$P(A \cap B)$ = (0.504)(0.8574) = 0.4321
Therefore, the probability that the circuit operates = $P(A \cup B) = P(A) + P(B) - P(A \cap B)$ = 0.9293