HW 2

For questions 2-4 refer to your textbook. Recall that the textbook uses the algebraic format for unions and intersections, i.e. (A ∪ B) => (A+B), and (A ∩ B) => (AB). You can use any format for this homework.

1) A missile can be accidentally launched if two relays *A* and *B* both have failed. The probabilities of *A* and *B* failing are known to be 0.01 and 0.03 respectively. It is also known that *B* is more likely to fail (probability 0.06) if *A* has failed.
    a. What is the probability of an accidental missile launch?
    b. What is the probability that *A* will fail if *B* has failed?
    c. Are the events "*A* fails" and "*B* fails" statistically independent?

2) Problem 2.9.

3) Problem 2.10.

4) Problem 2.12.

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1. a. $P(\text{launch}) = P(A_{fail} \cap B_{fail})$
$= P(B_{fail} \mid A_{fail})\, P(A_{fail})$
$= (0.06)(0.1)$
$= 0.0006$

b. $P(A_{fail} \mid B_{fail}) = P(A_{fail} \cap B_{fail}) \;/\; P(B_{fail})$
$= 0.0006 / 0.03$
$= 0.02$

c. $P(A_{fail})\,P(B_{fail}) \stackrel{?}{=} P(A_{fail} \cap B_{fail})$
$0.01(0.03) \stackrel{?}{=} 0.0006$
$0.0003 \neq 0.0006$ ∴ They are not independent

2. a. $Pr[A+B] = Pr[A] + Pr[B] = 1/4 + 1/3 = 7/12$

b. $Pr[A+B] = Pr[A] + Pr[B] - Pr[A]\,Pr[B]$
$= 1/4 + 1/3 - (1/4)(1/3) = 6/12 = 1/2$

c. It is not possible that all A, B, C, and D are mutually exclusive since it should be $Pr[A+B+C+D] > 1$ which is not possible

3. $Pr[\text{odd}] = x$
$Pr[\text{Even}] = 2x$
$\sum Pr[x] = 1 \rightarrow 6(x) + 6(2x) = 1$
$18x = 1 \longrightarrow x = 1/18$

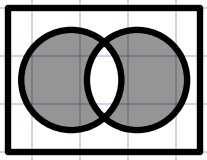
a. $Pr[A] = 6\,\text{odd} = 6x = 6(1/18) = 1/3$

b. $Pr[B] = 2\,\text{odd} + 3\,\text{even} = 2(x) + 3(2x) = 8x = 8(1/18) = 4/9$

c. $Pr[AB] = P(5) + P(7) = x + x = 2x = 2(1/18) = 1/9$

4. let A = Hard drive fail
B = Memory fail

$Pr[A] = 0.3 \quad Pr[A \cap B] = 0.1$
$Pr[B] = 0.2$

(a.) 

$Pr[A \cup B] - Pr[A \cap B]$
$Pr[A] + Pr[B] - Pr[A \cap B] - Pr[A \cap B]$
$= 0.3 + 0.2 - 2(0.1)$
$= 0.3$

(b) NO FAILURE $= 1 - Pr[A \cup B]$
$= 1 - (Pr[A] + Pr[B] - Pr[A \cap B])$
$= 1 - (0.3 + 0.2 - 0.1)$
$= 1 - 0.4$
$= 0.6$