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1st assignment

1.1 (i) sample space = {HTT, THT, TTH, HHT, HTH, THH, HHH}

(ii) 0 head = {TTT}, 1 head = {HTT, THT, TTH}, 2 heads = {HHT, HTH, THH}, 3 heads = {HHH}

1.2 same dice = 21, different dice = 36

1.3 $A = \{HHHT, HHHT, HTHH, THHH, HHHH\}$

$A' = \{TTTT, TTTH, TTHT, THTT, HTTT, HHTT, HTHT, HTTH, THHT, THTH, TTHH\}$

1.4 (a) $A \cap B = \{3, 4\}$

(b) $A \cup B = \{0, 1, 2, 3, 4, 5, 6\}$

(c) $A \cup C = \{0, 1, 2, 3, 4, 5\}$

(d) $(A \cup C)' = \{6\}$

1.5 ${}_{10}P_4 = \frac{10!}{6!} = 5040$

1.6 $P(\text{odd number}) = \frac{2}{1+1+1+2+2+2} = \frac{2}{9}$

$P(\text{even number}) = \frac{1}{1+1+1+2+2+2} = \frac{1}{9}$

$P(6) = P(4) + P(5) + P(6) = \frac{1}{9} + \frac{2}{9} + \frac{1}{9} = \frac{4}{9}$

1.7 (i) $P(M \cap B) = P(M)P(B) = 0.95 + 0.80 - 0.99 = 0.76$

(ii) $P(M' \cap B) = P(B) - P(M \cap B) = 0.80 - 0.76 = 0.04$

(iii) $P(M \cup B)' = 1 - P(M \cup B) = 1 - 0.99 = 0.01$

1.8 (i) $P(L|T) = \frac{P(L \cap T)}{P(T)} = \frac{0.01}{0.05} = \frac{1}{5}$

(ii) $P(T|L) = \frac{P(L \cap T)}{P(L)} = \frac{0.01}{0.80} = \frac{1}{80}$

(iii) $P(T \cap L') = P(T) - P(T \cap L) = 0.05 - 0.01 = 0.04$

(iv) $P(T|L') = \frac{P(T \cap L')}{P(L')} = \frac{P(T) - P(T \cap L)}{1 - P(L)} = \frac{0.05 - 0.01}{1 - 0.80} = \frac{0.04}{0.20} = \frac{1}{5}$

1.9 (i) $P(R) = P(M) + P(S) = \frac{3}{4} \times \frac{9}{10} + \frac{1}{4} \times \frac{5}{10} = \frac{27}{40} + \frac{5}{40} = \frac{32}{40} = \frac{4}{5}$

(ii) $P(M|R) = \frac{P(M \cap R)}{P(R)} = \frac{P(M)}{P(R)} = \frac{\frac{3}{4}}{\frac{4}{5}} = \frac{15}{16} = \frac{27}{32}$

1.10 (i) $P(D) = P(D|m_1)P(m_1) + P(D|m_2)P(m_2) + P(D|m_3)P(m_3)$
 $= 0.05 \times 0.20 + 0.03 \times 0.30 + 0.02 \times 0.50 = 0.029$

(ii) $P(m_1|D) = \frac{P(D|m_1)P(m_1)}{P(D)} = \frac{0.05 \times 0.20}{0.029} = \frac{0.010}{0.029} = \frac{10}{29}$