1. $P(A) = 0.8, P(B) = 0.5$ and $P(A \cap B) = 0.8 + 0.5 - 0.9 = 0.4$. Then $P(A) * P(B) = 0.4$. So A, B are independent.

7 $P(A_1) = 0.5, P(A_2) = 0.7$, and $P(A_3) = 0.6$, such that A_i are independent for $i = 1, 2, 3$.

(a) Need the following three probabilities A_i is successful and the others aren't, for $i = 1, 2, 3$. $P(A_1 \cap A_2' \cap A_3') + P(A_1' \cap A_2 \cap A_3') + P(A_1' \cap A_2' \cap A_3) = 0.5 * 0.3 * 0.4 + 0.5 * 0.7 * 0.4 + 0.5 * 0.3 * 0.6 = 0.29$.

(b) $P($ exactly two $) = 1 - P($ exactly one $) - P($ all three $) - P($ none $) = 1 - 0.29 - 0.5 * 0.7 * 0.6 - 0.5 * 0.3 * 0.4 = 0.44$.

11 (a) If A, B are mutually exclusive, non empty events, then they are always dependent since $P(A) > 0$ and $P(B) > 0$ but $P(A \cap B) = 0$. If either or both sets are empty then they will be independent.

(b) Independence follows only if the set $B = \mathbb{S}$.

12 Since $a)$ through $c)$ each has two tails, the probabilities are all the same $0.5^5 = 1/32$. For part $d)$, since there are many different ways to get three heads, as suggested in parts $a)$ through $c)$, we need count the number of ways to get three heads in five trials, $\binom{5}{3}$. Hence, the answer the part $d)$ is $\binom{5}{3}(1/2)^3(1/2)^2$