

Discrete Math	Section	01 or 02
	Student number	21900706
Homework 5	Name	조영관

// Print this document and write solutions **by your hand**.

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// format) Homework1_StudentNumber_Name.pdf

ex) Homework1_2170011_KimHandong.pdf

1) probability of getting number a from die = $p(a)$

$$p(1) = p(2) = p(4) = p(5) = p(6) = 5x$$

$$p(3) = 2x$$

$$\hookrightarrow 7x = 1$$

$$x = \frac{1}{7}$$

$$p(1) = p(2) = p(4) = p(5) = p(6) = \frac{1}{7} = 0.1429$$

$$p(3) = \frac{2}{7} = 0.2857$$

2) since E and F are independent

$$P(E \cap F) = P(E) \cdot P(F)$$

$$P(\overline{E}) \cdot P(\overline{F}) = (1 - P(E))(1 - P(F))$$

$$= 1 - P(E) - P(F) + P(E) \cdot P(F)$$

$$= 1 - P(E) - P(F) + P(E \cap F)$$

$$= 1 - (P(E) + P(F) - P(E \cap F))$$

$$= 1 - P(E \cup F)$$

$$= P(E \cap F)$$

Thus, \overline{E} and \overline{F} are also independent

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$$3) p(b) = 0.51 \quad p(g) = 0.49$$

$$p(b \cap g) = p(b) \cdot p(g) = 0.2499$$

$$a) 5 \cdot (0.51)^3 \cdot (0.49)^2 = 0.3185$$

$$b) 1 - 5 \cdot (0.49)^5 = 0.9718$$

$$c) 1 - 5 \cdot (0.51)^5 = 0.9655$$

$$d) 5 \cdot (0.51^5 + 0.49^5) = 0.0627$$

$$4) P(E) = \frac{2}{3} \quad P(\bar{E}) = \frac{1}{3} \quad P(F|E) = \frac{5}{8}$$

$$P(F) = \frac{3}{4} \quad P(\bar{F}) = \frac{1}{4}$$

$$\begin{aligned}
 P(E|F) &= \frac{P(F|E) \cdot P(E)}{P(F|E)P(E) + P(F|\bar{E})P(\bar{E})} \\
 &= \frac{P(F|E) \cdot P(E)}{P(F \cap E) + P(F \cap \bar{E})} = P(F) \\
 &= \frac{\frac{5}{8} \times \frac{2}{3}}{\frac{3}{4}} \\
 &= \frac{5}{6} = 0.8333
 \end{aligned}$$

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$$\begin{aligned}
 5) \quad P(F_2|E) &= \frac{P(E|F_2)P(F_2)}{P(E|F_1)P(F_1) + P(E|F_2)P(F_2) + P(E|F_3)P(F_3)} \\
 &= \frac{\frac{3}{8} \times \frac{1}{2}}{\frac{2}{7} \times \frac{1}{6} + \frac{3}{8} \times \frac{1}{2} + \frac{1}{2} \times \frac{1}{3}} \\
 &= \frac{7}{15} \\
 &= 0.4667
 \end{aligned}$$

6) $E = \text{exciting}$
 $F_1 = \text{spam}$
 $F_2 = \text{not-spam}$

$$\begin{aligned}
 P(F_1|E) &= \frac{P(E|F_1)P(F_1)}{P(E|F_1)P(F_1) + P(E|F_2)P(F_2)} \\
 &= \frac{\frac{40}{500} \times \frac{500}{700}}{\frac{40}{500} \times \frac{500}{700} + \frac{25}{200} \times \frac{200}{700}} \\
 &= \frac{8}{13} < 0.9
 \end{aligned}$$

Thus, the messages containing word "exciting" should not be rejected.