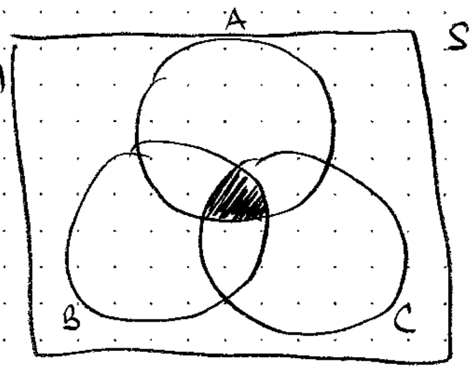
NEVIN LIANG
MIDTERM 1

2:38 PM
EE 131A

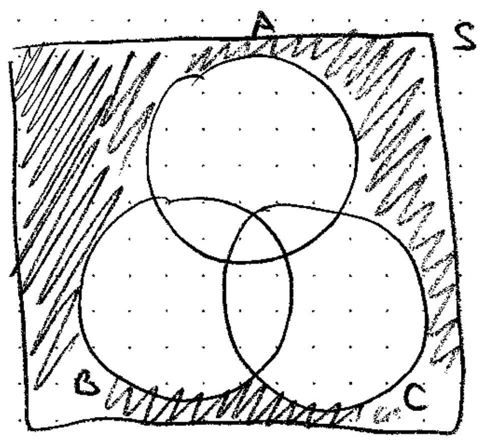
I, NEVIN LIANG, with UID 705575353 have read and understood the policy of academic integrity.

(1) (a)



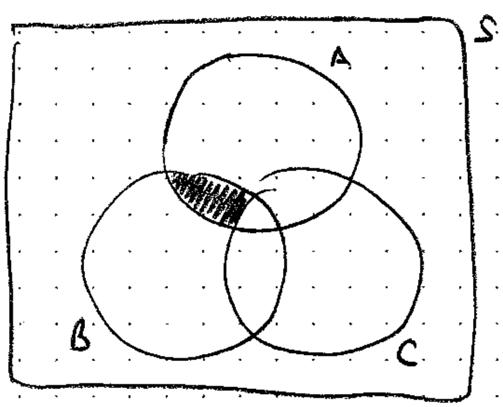
$\boxed{A \cap B \cap C}$

(b)



$\boxed{(A \cup B \cup C)^c}$

(c)



$\boxed{A \cap B \cap C^c}$

(2)

(a) $P(A \cap B) = P(A) + P(B) - P(A \cup B)$

$= \frac{2}{10} + \frac{3}{10} - \frac{4}{10} = \boxed{\frac{1}{10}}$

(b) $P(A|B) = \frac{P(A \cap B)}{P(B)} = \frac{1/10}{3/10} = \boxed{\frac{1}{3}}$

(c) $P(B|A) = \frac{P(B \cap A)}{P(A)} = \frac{1/10}{2/10} = \boxed{\frac{1}{2}}$

(3)

(a) $E(X) = (-2)\cdot\frac{1}{4} + 0\cdot\frac{1}{2} + 2\cdot\frac{1}{4} = \boxed{0}$

$Var(X) = E(X^2) - E(X)^2$

$E(X^2) = 4\cdot\frac{1}{4} + 0\cdot\frac{1}{2} + 4\cdot\frac{1}{4} = 2$

$Var(X) = 2 - 0^2 = \boxed{2}$

(b) $Y = \begin{cases} 4 & 1/4 \\ 0 & 1/2 \\ 4 & 1/4 \end{cases}$

$E(X) = 4\cdot\frac{1}{4} + 0 + 4\cdot\frac{1}{4} = \boxed{2}$

$Var(X) = E(X^2) - E(X)^2$

$E(X^2) = 16\cdot\frac{1}{4} + 0 + 16\cdot\frac{1}{4} = 8$

$Var(X) = 8 - 2^2 = \boxed{4}$

(c) $E[XY] = (-2)(4)\cdot\frac{1}{16} + (-2)\cdot(0)\frac{1}{8} + (-2)\cdot(4)\cdot\frac{1}{16} +$

$(0) \cdots\cdots +$

$(2)(4)\cdot\frac{1}{16} + (2)\cdot(0)\cdot\frac{1}{8} + 2\cdot 4\cdot\frac{1}{16} = \boxed{0}$

(d) $E[XY] = E[X]\cdot E[Y]$ therefore, they are

$\boxed{\text{uncorrelated}}$

(4)

$$\frac{7}{10}\cdot\frac{6}{9}\cdot\frac{5}{8} = \frac{7}{\cancel{10}_{2}}\cdot\frac{1}{3}\cdot\frac{\cancel{5}}{4} = \boxed{\frac{7}{24}}$$

P(3 b balls in a row) =

(5)

(a) $S: \{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\}$

(b) $P(1H) = 3 \cdot \frac{1}{4} \cdot \frac{3}{4} \cdot \frac{3}{4} = \boxed{\frac{27}{64}}$

(6)

(a) This is a binomial random variable

$$E = \frac{1}{p} = \frac{1}{1/4} = \boxed{4} \text{ boxes.}$$

(b) by linearity of expectation, the expected # of boxes for the second is just

$$4+4 = \boxed{8} \text{ boxes}$$