1) Letting $B_1$ be the event the 1st ball is black, $B_2$ be the event the 2nd ball is black, $W_1$ be the event the 3rd ball is white, and $W_2$ be the event the 4th ball is white, the desired probability is

$$P(B_1 B_2 W_1 W_2),$$

which is equal to

$$P(W_2|B_1 B_2 W_1)P(W_1|B_1 B_2)P(B_2|B_1)P(B_1) = (6/16)(4/14)(8/12)(6/10) = 3/70 \approx 0.0429.$$ 

2) Letting $F$ be the event the student is female and $C$ be the event the student is majoring in computer science, the desired probability is

$$P(F|C) = \frac{P(F \cap C)}{P(C)} = 0.02/0.06 = 1/3 \approx 0.333.$$ 

3) Letting $N_i$ be the event that exactly $i$ of the first three balls drawn are new, and $E$ be the event that the single ball drawn is new, the desired probability is

$$P(E) = \sum_{i=0}^{3} P(E|N_i)P(N_i)$$

$$= \sum_{i=0}^{3} \binom{9-i}{3} \binom{6}{3-i} \frac{1}{15} \frac{1}{15}$$


$$= 12/25$$

$$= 0.48.$$ 

4) Bayes’s formula can be used. Letting $H$ be the event the coin results in heads, and $W$ be the event the ball selected is white, the desired probability is

$$P(H^C|W) = \frac{P(W|H^C)P(H^C)}{P(W|H)P(H) + P(W|H^C)P(H^C)}$$

$$= \frac{(3/15)(1/2)}{(4/12)(1/2) + (3/15)(1/2)}$$

$$= \frac{(1/5)(1/2)}{(1/3)(1/2) + (1/5)(1/2)}$$

$$= \frac{(1/5)}{(1/3) + (1/5)}$$

$$= 3/8$$

$$= 0.375.$$