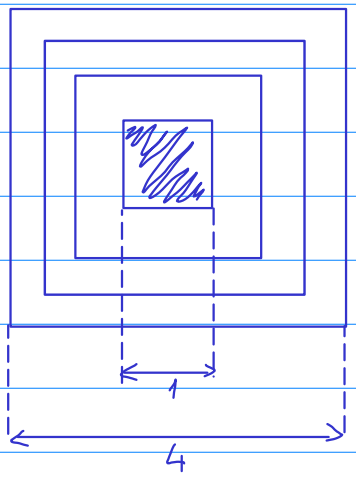
1) $P(3 \text{ on die and tail on coin})$

$= P(3 \text{ on die}) \, P(\text{tail on coin})$ (because of independence)

$= \frac{1}{6} \cdot \frac{1}{2}$

$= \frac{1}{18}$

2)



$P(\text{at least one dart in center square})$

$= 1 - P(\text{both darts outside center square})$

$= 1 - P(\text{dart 1 outside}) \, P(\text{dart 2 outside})$

(because of independence)

$P(\text{dart 1 outside center square})$

$= 1 - P(\text{dart 1 inside center square})$

$= 1 - \frac{\text{area of center square}}{\text{area of largest square}}$

$= 1 - \frac{1^2}{4^2} = \frac{15}{16}$

Final answer:

$$P = 1 - \frac{15}{16} \times \frac{15}{16} = \frac{31}{256}.$$

3) This is a binomial experiment.

$n =$ number of trials $= 4$

$k =$ number of success $= 3$

$p =$ probability of success per trial $= \frac{1}{2}$

$$P(\text{exactly 3 tails}) = C(4,3) \left(\frac{1}{2}\right)^3 \left(1 - \frac{1}{2}\right)^{4-3} = 4 \times \frac{1}{8} \times \frac{1}{2} = \frac{1}{4}.$$

4) $n = 5$ (number of trials)

$p = \frac{1}{6}$ (probability of getting 1)

$$P(\text{getting} \geq \text{three 1's}) = P(\text{getting three 1's}) + P(\text{getting four 1's}) + P(\text{getting five 1's})$$

$$= C(5,3)\left(\frac{1}{6}\right)^3\left(\frac{5}{6}\right)^2 + C(5,4)\left(\frac{1}{6}\right)^4\left(\frac{5}{6}\right)^1 + C(5,5)\left(\frac{1}{6}\right)^5\left(\frac{5}{6}\right)^0$$

$$= \frac{10 \times 25}{6^5} + \frac{5 \times 5}{6^5} + \frac{1}{6^5}$$

$$= \frac{276}{7776} \approx 0.0355$$

5) $$P(\text{sum} = 6 \mid \text{sum even}) = \frac{P(\text{sum} = 6 \text{ and even})}{P(\text{sum is even})} = \frac{P(\text{sum} = 6)}{P(\text{sum even})}$$

Event that sum $= 6$ is $\{15, 24, 33, 42, 51\}$

Event that sum is even is $\{11, 13, 15, 22, 24, 26, \ldots\}$ (18 of them)

$$P(\text{sum} = 6) = \frac{5}{36}$$

$$P(\text{sum even}) = \frac{18}{36} = \frac{1}{2}$$

$$P(\text{sum} = 6 \mid \text{sum even}) = \frac{5/36}{1/2} = \frac{5}{18}$$

6) There are queens. Only one of them is a spade.

$$P(\text{spade} \mid \text{queen}) = \frac{1}{4}$$

7) G = event that G is reelected

A = event that Al wins nomination

B = event that Bill wins nomination

Law of total probability:

$$P(G) = P(G|A)P(A) + P(G|B)P(B)$$

$$= \frac{1}{2} \times \frac{2}{3} + \frac{1}{3} \times \frac{1}{3}$$

$$= \frac{4}{9}$$