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CS 395

HW2

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1. Ans: The bridges are labeled A, B, and C.

The probability that bridge A is up is 98%.
= 0.98

The probability that bridge B is up is 97%.
= 0.97

The probability that bridge C is up is 96%.
= 0.96

The probability that on any day an ambulance can drive from Eastville to the hospital in Backton is :- 1 − P(none of the three bridges are up)

= 1 − P(A is not up) × P(B is not up) × P(C is not up)

= 1 − (1 − 0.98) × (1 − 0.97) × (1 − 0.96)
= 1 − (0.02) × (0.03) × (0.04)
= 1 − 0.000024
= 0.999976

2. Ans. Here, $P(1) + P(2) + P(3) + P(4) + P(5) + P(6) = 1$

$$P(1) = P(3) = P(5)$$

$$P(2) = P(4) = P(6)$$

Now, $P(2) = 2 \times P(1)$

$P(1) + P(2) + P(3) + P(4) + P(5) + P(6) = 1$
$P(1) = P(3) = P(5)$
$P(2) = P(4) = P(6) = 2 \times P(1)$

$\Rightarrow P(1) + P(2) + P(3) + P(4) + P(5) + P(6) = 1$
$\Rightarrow P(1) + (2 \times P(1)) + P(1) + (2 \times P(1)) + P(1) + (2 \times P(1)) = 1$

$\Rightarrow P(1)(1+2+1+2+1+2) = 1$
$\Rightarrow P(1) \times (9) = 1$
$\Rightarrow P(1) = \frac{1}{9}$

$\Rightarrow P(1) = P(3) = P(5) = \frac{1}{9}$

$\Rightarrow P(2) = P(4) = P(6) = \frac{2}{9}$

The probability that the outcome is less than 4 $= P(1) + P(2) + P(3)$

$$= \frac{1}{9} + \frac{2}{9} + \frac{1}{9}$$

$$= \frac{4}{9} = 0.4444$$

3. Ans:- (a) When we roll two fair 6-sided dice, then doubles can be rolled in the form of :- (1,1), (2,2), (3,3), (4,4), (5,5), (6,6).

Total outcome of doubles = 6

$N = 6$.

There are 36 possible outcomes when 2 fair six sided dice are rolled.

$\therefore n = 36$.

Probability that doubles are rolled

$$= \frac{N}{n}$$

$$= \frac{6}{36}$$

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

(b) When two fair 6-sided dice are rolled, then the outcomes whose sum is 4 or less than 4 are :- (1,1), (1,2), (1,3), (2,1), (2,2), (3,1).

Here, two doubles are present = (1,1) & (2,2).

Conditioned probability that doubles are rolled

$$P(E) = \frac{2}{6}$$

$$= \frac{1}{3}$$

(c) No of possible outcomes where at least one die roll is a 6 = (1,6), (2,6), (3,6), (4,6), (5,6), (6,5), (6,4), (6,3), (6,2), (6,1), (6,6).

∴ Here, total no of outcomes = 11

∴ Probability that at least one die roll is a 6 = $\frac{11}{36}$

(d) Since two dice are rolled, the total number of outcomes will be 36.

Outcomes when the dice lands on same number is (1,1), (2,2), (3,3), (4,4), (5,5), (6,6).

Here, there are 6 outcomes.

∴ No of outcomes where the dice land on different number = 36 - 6
= 30 outcomes

Now, out of 30 outcomes, the outcomes where at least one die roll is a 6
= (1,6), (2,6), (3,6), (4,6), (5,6), (6,5), (6,4), (6,3), (6,2), (6,1)

Here, total outcomes = 10

Conditional probability that at least one die roll is a 6 = $\frac{10}{30} = \frac{1}{3}$

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4 days: The possible outcomes when you roll a four-sided die are :- 1, 2, 3, 4

Let E denote getting an even number {either 2 or 4}

And O denote getting an odd number {either 1 or 3}

Now, a four-sided die is rolled repeatedly, until the first time (if ever) than an even number is obtained.

Let E = We get an even number on the 1st attempt.

Let OE = We get an even number on the 2nd attempt, with O representing an odd number on other attempts

Let OOE = We get an even number on the third attempt, with the O's representing odd numbers on other attempts.

& so on.

∴ Sample space, S = {E, OE, OOE, OOOE, OOOOE, ... }