

## חלק א - שאלות תיאורטיות

1. א.  $\frac{1}{125}$  מהליות - תיאורים 10 זנים.

$\frac{1}{300}$  מהליות - תיאורים 300 זנים.

הסתברות לתיאור זמן:

$$\frac{1}{2} \times \frac{1}{125} + \frac{1}{300} = \frac{300 + 250}{75000} = \frac{22}{3000} = \frac{11}{1500}$$

הסתברות לתיאור זמן: אין:

לכן זה חוק כיס:

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

$$P(\text{תיאור זמן} | \text{זמן}) = \frac{P(\text{תיאור זמן})}{P(\text{זמן})} = \frac{\frac{1}{300}}{\frac{11}{1500}} = \frac{5}{11}$$

Bowl 1: 10 a cookies, 30 c cookies.

ב.

Bowl 2: 20 a cookies, 20 c cookies.

$$P(\text{chocolate from bowl 1}) = \frac{3}{4}$$

$$P(\text{chocolate from bowl 2}) = \frac{2}{4}$$

$$P(\text{bowl 1 | chocolate}) = (3/4) / (5/4) = \frac{3}{5}$$

$$P(\text{yellow} \cap 1994) \times P(\text{green} \cap 1996) = (0.2)(0.2) = 0.04$$

2.

$$P(\text{yellow} \cap 1996) \times P(\text{green} \cap 1994) = (0.14)(0.1) = 0.014$$

$$P(1994 | \text{yellow}) = \frac{P(1994 \cap \text{yellow})}{P(\text{yellow})} = \frac{0.04}{0.054} = \frac{40}{54} = 0.741$$

statistically 1/1000 has the flu

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99% accurate (1% that a healthy person would be told he's sick).

כל אדם בסיכון 1% להיחלש, והסיכון של 1% לא יעלה על 1%.

$$P(\text{Not having flu} | \text{testing pos}) = 0.01$$

$$P(\text{testing positive}) = p(\text{pos} | \text{flu}) \times p(\text{flu}) + p(\text{pos} | \text{healthy}) \times p(\text{healthy}) =$$

$$(0.99 \times 1/10000) + (0.01 \times 9999/10000) = 0.010098$$

$$P(\text{having the flu} | \text{positive}) = \frac{p(\text{having flu} \cap \text{positive})}{p(\text{positive})} = 0.0098 = 0.98\%$$

$$P(\text{having the flu} \& \text{positive}) = \frac{1}{200}$$

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$$P(\text{Positive}) = \frac{1}{200} + \frac{1}{100}$$

$$P(\text{having the flu} | \text{Positive}) = (1/200) / (3/200) = 1/3$$



$1/300$  identical twins

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$1/125$  not identical twins.

$$P(\text{same sex twins}) = \frac{1}{2} \times \frac{1}{125} + \frac{1}{300} = \frac{300 + 250}{75000} = \frac{22}{3000} = \frac{11}{1500}$$

$$P(\text{identical twins}) = \frac{\frac{1}{300}}{\frac{11}{1500}} = \frac{5}{11} = 0.4545$$

## Random variables

1. 2 six sided dice : if sum  $\leq 3$  wins 6\$

sum divisible by 3 can be: 3, 6, 9, 12

If sum  $> 3$  loses 3\$

sum can be anything other than above.

the probability of sum  $\leq 3$  is  $4/12$

therefore sum of sum  $> 3$  is  $8/12$ .

$$\Rightarrow \text{Expected value} = (6)(1/3) + (-3)(2/3) = (2) + (-2) = 0\$$$

2. below 12 = 1+6, 2+6, 3+6, 4+6, 5+6,

1+7, 2+7, 3+7, 4+7,

1+8, 2+8, 3+8,

1+9, 2+9

1+10  $\Rightarrow$  15 options

exactly 12 = 2+10, 3+9, 4+8, 5+7  $\Rightarrow$  4 options

over 12 = 10+5, 10+4, 10+3,

9+5, 9+4,

8+5  $\Rightarrow$  6 options

$$\Rightarrow P(\text{over}) = 15/25, P(\text{exactly}) = 4/25, P(\text{below}) = 6/25$$

$$\Rightarrow \text{Expected} = 5(6/25) - 6(15/25) = -2.4\$$$



3. number of males =  $200 \times 0.4 = 80$

mean =  $0.4 \times 8 = 3.2$

standard deviation =  $\sqrt{(0.4)(1-0.4)/8} = 0.1732$

4. formula to calculating z score is  $(x - \text{mean}) / \text{std}$

$\Rightarrow P(26 < X < 30) = P((26-26)/2 < X < ((30-26)/2))$

$= P(0 < X < 2) = P(X < 2) - P(X < 0) =$

$0.97725 - 0.5 = 0.477$

5.  $P(X > 3) = \frac{1}{2} (2)(0.4) = 0.4$

6.  $500 \times 0.6 = 300$  employees have kids.

$\binom{4}{3} (0.6)^3 (0.4) = 0.3456 = 0.35$

7.  $(-10)(0.1) + (-5)(0.35) + (0)(0.1) + (5)(0.35) + (10)(0.1) = 0$