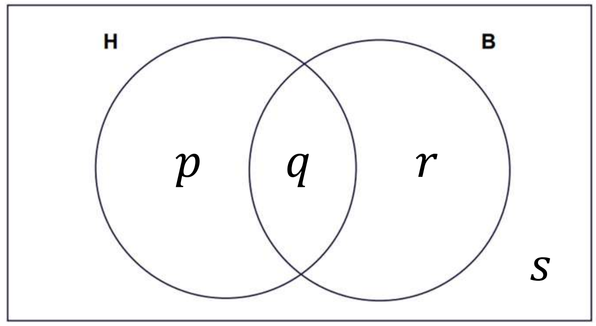
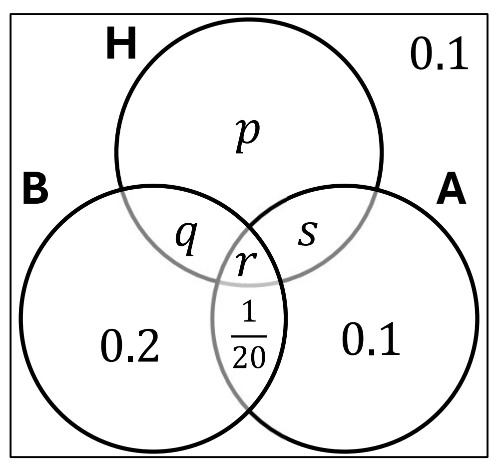


Write the following probabilities in terms of p, q, r and s

a) $P(H)$
b) $P(B)$
c) $P(A)$
d) $P(H \cap B)$
e) $P(B \cap H)$
f) $P(H \cup B)$
g) $P(B \cup H)$
h) $P(H\ given\ B)$
i) $P(B\ given\ H)$
j) $P(H|B)$
k) $P(B|H)$
l) $P(H')$
m) $P(B')$
n) $P(A')$
o) $P(H' \cap B)$
p) $P(B' \cap H)$
q) $P(H \cup B')$
r) $P(B \cup H')$
s) $P(H'\ given\ B)$
t) $P(B'\ given\ H)$
u) $P(H|B')$
v) $P(B|H')$

Challenge:
Find all the probabilities for the Venn Diagram below



Do p, q, r and s represent probabilities, proportions or frequencies? Does it matter? Explain your answer

Tom believes there is a correlation between weight and average systolic blood pressure for adult males.

He calculates the product moment correlation coefficient of this sample and obtains:

$$r = 0.6497 \text{ to 4d.p.}$$

b) Carry out a suitable test to investigate Tom's belief at a 5% level of significance.

State clearly:

- your hypotheses
- your critical value

Critical values for correlation coefficients are given at the end of this question.

[3]

The equation of the line of best fit for average systolic blood pressure on weight for this sample is:

$$y = 0.574x + 80.9$$

c) Give an interpretation of the gradient of this regression equation.

[1]

b) $H_0 = 0.6497$

$h_1: r \neq 0.6497$

Sig level 5%

$n = 20$

As $0.3783 < 0.6497$ it is not significant. Therefore, there is no correlation.

c) The rate of change of weight.

Product Moment Coefficient					
Level					Sample size, n
0.10	0.05	0.025	0.01	0.005	
0.8000	0.9000	0.9500	0.9800	0.9900	4
0.6870	0.8054	0.8783	0.9343	0.9587	5
0.6084	0.7293	0.8114	0.8822	0.9172	6
0.5509	0.6694	0.7545	0.8329	0.8745	7
0.5067	0.6215	0.7067	0.7887	0.8343	8
0.4716	0.5822	0.6664	0.7498	0.7977	9
0.4428	0.5494	0.6319	0.7155	0.7646	10
0.4187	0.5214	0.6021	0.6851	0.7348	11
0.3981	0.4973	0.5760	0.6581	0.7079	12
0.3802	0.4762	0.5529	0.6339	0.6835	13
0.3646	0.4575	0.5324	0.6120	0.6614	14
0.3507	0.4409	0.5140	0.5923	0.6411	15
0.3383	0.4259	0.4973	0.5742	0.6226	16
0.3271	0.4124	0.4821	0.5577	0.6055	17
0.3170	0.4000	0.4683	0.5425	0.5897	18
0.3077	0.3887	0.4555	0.5285	0.5751	19
0.2992	0.3783	0.4438	0.5155	0.5614	20
0.2914	0.3687	0.4329	0.5034	0.5487	21
0.2841	0.3598	0.4227	0.4921	0.5368	22
0.2774	0.3515	0.4133	0.4815	0.5256	23
0.2711	0.3438	0.4044	0.4716	0.5151	24
0.2653	0.3365	0.3961	0.4622	0.5052	25

Spot all the mistakes in the students answer

Find the probabilities for the two given distributions	$X \sim B(10, 0.1)$	X = Number of red sweets We have 20 sweets in a jar and there are 3 red sweets
$P(X = 3)$		
$P(X < 3)$		
$P(X \leq 3)$		
$P(X > 3)$		
$P(X \geq 3)$		
$P(3 < X < 5)$		
$P(3 \leq X < 5)$		
$P(3 < X \leq 5)$		
$P(3 \leq X \leq 5)$		
$P(Atleast\ 3)$		
$P(More\ than\ 3)$		
$P(Less\ than\ 3)$		
$P(3\ or\ fewer)$		
$P(between\ 3\ and\ 5)$		
$P\left(between\ 3\ and\ 5\ (inclusive)\right)$		

Discrete Probability	Number line	Continuity Correction
$P(X = 3)$	2 3 4	
$P(X < 3)$	2 3 4	
$P(X \leq 3)$	2 3 4	
$P(X > 3)$	2 3 4	
$P(X \geq 3)$	2 3 4	
$P(3 < X < 5)$	2 3 4 5 6	
$P(3 \leq X < 5)$		
$P(3 < X \leq 5)$		
$P(3 \leq X \leq 5)$		
$P(Atleast\ 3)$		
$P(More\ than\ 3)$		
$P(Less\ than\ 3)$		
$P(3\ or\ fewer)$		
$P(between\ 3\ and\ 5)$		
$P(between\ 3\ and\ 5\ (inclusive))$		

Situation	Define your test statistic and your model	State your hypothesis	What would you expect	Critical Region	P value	Actual Significance Level	Conclusion with context	Any critiques of using a binomial model for the situation?
I roll a dice 30 times and notice that I rolled 6 once I want to test at a 5% significance level whether the dice is biased **against** getting a six.								
Jake grows cucumbers and finds that over time 60% of his cucumbers are heavier than 2kg. Jake then gets a new fertiliser which claims that the fertiliser will increase the proportion of cucumber that are heavier than 2kg. Jake takes a random sample of 30 cucumbers and wants to test the claim at a 5% sig level.								
David rolls an eight-sided dice 120 times and finds that it lands on 8 25 times. Use a two tailed test with a significance level of 5% to determine whether there is sufficient evidence to conclude that the dice is biased.								
A farmer knows from experience that one egg in every 50 eggs has a triple yolk. The farmer decides to change the type of feed that he uses. He wants to carry out a hypothesis test to determine whether the feed effects the chance of a triple yolk. In a random sample of 50 eggs he finds that 3 have a triple. Test at a 10% sign level whether the chance of a triple yolk has changed.								

Situation	Define your test statistic and your model	State your hypothesis	What would you expect	Critical Region	P value	Actual Significance Level	Conclusion with context	Any critiques of using a binomial model for the situation?
5% significance level	X = Numbers of heads when flipping a coin	$H_0: p = 0.5$ $H_1: p < 0.5$	40 heads		0.0464559411			
		$H_0: p = 0.2$ $H_1: p > 0.2$	2	$X \geq 5$				
	$X \sim B(30, p)$	$H_0: p =$ $H_1: p \neq$			$P(X \leq 10)$ $= 0.0494$		There is insufficient evidence to reject the null hypothesis so there is not enough reason to doubt that $p = 0.5$	
	$X \sim B(20, p)$					0.0210289274	As $0.1275 > 0.025$ there is insufficient evidence to suggest a change	

Spot all the mistakes in each of these students' answers

Ayesha has studied recent data and believes that the heights of adult women in the US can be modelled by a Normal distribution with a mean of 161cm. The standard deviation is found to be 7

Sarah believes the average height of a women in the UK is greater than the US.

She selects a random sample of 35 women from the UK and finds that their mean height is 163cm.

c) Stating your hypotheses clearly and using a 5% significance level, test whether there is evidence to support Sarah's claim.

[5]

$$\bar{X} \sim N\left(163, \frac{7^2}{35}\right)$$

$$\bar{\sigma} = \sqrt{\frac{7^2}{35}}$$

$$H_0: p = 163$$
$$H_1: p > 163$$

$$P(\bar{X} > 161) = 0.955$$

As $0.955 > 0.05$ there is insufficient evidence to reject H_0

$$\bar{X} \sim N(161, 7^2)$$
$$\bar{\sigma} = 7$$

$$H_0: \mu = 161$$
$$H_1: \mu < 161$$

$$P(\bar{X} < 163) = 0.516$$

As $0.516 > 0.05$ there is insufficient evidence to reject H_0

Find the value of k for each of the following probability distributions

x	1	2	3
$P(X = x)$	0.1	0.2	k

x	1	2	3
$P(X = x)$	0.1	$2k$	k

The probability of getting a 2 is half the probability of getting a 3

x	1	2	3
$P(X = x)$	0.1		

$P(X = x) = kx$

x	1	2	3
$P(X = x)$			

$P(X = x) = kx$

x	2	3
$P(X = x)$	0.4	

We are rolling a biased six- sided dice

$P(X = x) = \frac{x}{k}$

x						
$P(X = x)$						

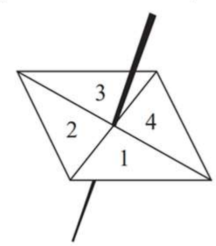
We are rolling a biased Five - sided dice

$P(X = x) = \frac{x^2 + x}{k}$

x	
$P(X = x)$	

I spin the following biased spinner

$P(X = x) = \frac{x^2}{k}$



Mika has a board game that contains a biased spinner.
The spinner can only land on the numbers 1, 2 or 3.
The random variable X represents the number that the spinner lands on after a single spin.
The company who makes the board game tell us that the probability distribution of X is given by: $P(X = x) = \frac{x^2+x}{k}$

State the value of k and find the complete probability distribution of X.

This table represents the probability distribution of a spinner

x	1	2	3
$P(X = x)$	0.1	0.2	0.7

1. The spinner is spun once.
   a) What is the probability of getting a 2
   b) $P(X = 3)$
   c) What is the probability of getting 1 or 2
   d) $P(2 \cup 3)$
   e) $P(2 \cap 3)$
   f) $P(X > 1)$
   g) $P(X \geq 1)$

		First Spin		
		1	2	3
Second Spin	1			
	2			
	3			

2. The spinner is spun twice, and the values are added together
   a) Complete the sample space diagram above to represent all the possible outcomes
   b) What is the probability that the total score is 1?
   c) $P(total\ score\ = 3)$
   d) $P(total\ score > 4)$
   e) $P(total\ score \geq 4)$

3. The spinner is spun twice.
   a) What is the probability that the first spin is equal to the second spin?
   b) What is the probability that the second spin is less than the first spin?
   c) What is the probability that the second spin is more than the first spin?

4. The spinner is spun n times. Find in terms of n.
   a) The probability that you get a 1 every time.
   b) The probability that you get the same number every time.

5. Daniel has a board game with a biased spinner that can only land on 1, 2, 3 or 4. The random variable X represents the number that the spinner lands on after a single spin. The probability distribution of X is given by:

$$P(X = x) = \frac{x^2 + x}{k}$$

   a) Find the value of k and find the complete probability distribution.

When playing the board game, the spinner is spun twice per round.

   b) Using the probability distribution given above, find the probability that Daniel's first spin is higher than his second spin.
   c) Daniel plays 15 rounds, find the probability that Daniel's first spin is higher than his second spin on more than 10 of the rounds.