

Needs p to calculate p(x)

7.2. Suppose a psychologist is studying whether or not people can decide if another person has an IQ score of greater than 100. Ten different people are shown ten different images of another person for 2.0 seconds. So you can think of an individual photo as a trial, and each participant as a run. The frequency with which the participants said yes, $IQ > 100$ is shown in Tab. 2. (a) Fill in Tab. 2. (b) Are the data distributed following a binomial distribution? Assuming they are, what is the p value that satisfies $\mu = Np$?

x	N_{total}	$p(x)$	$x * p(x)$
0	0	.1	0
1	0	.1	0
2	0	.1	0
3	0	.1	0
4	1	.1	.1
5	0	.1	0
6	3	.1	.3
7	6	.1	.6
8	0	.1	0
9	0	.1	0
10	0	.1	0

Table 2: A table displaying the frequencies with which participants decided random photos of people corresponded to an IQ score of larger than 100 or not. The left column is the discrete random variable x ; the total number of times the participant decided a photo corresponding to a high IQ. The middle column is the frequency with which x occurs across 10 runs.

- b) Based on what I know about the experiment, I believe the participants are guessing randomly since many are don't know if the other person has a IQ score of greater than 100.
- c) Yes, the data is following a binomial distribution since there are two high data points. P-value = 10%.

#4. **Private Dice.** Imagine you are kidnapped by pirates and to pass the time between scrubbing the deck and serving scotch, you wager on dice. Each of four players has two dice and the players roll his or her dice but hides them from sight after looking at them. The players have turns stating how many of the four players they think will lose from their example, if one player thinks the claim is false (a lie), then they call that liar. If the player's claim is true, then they are out. For example, if one player says (1,2), (3,4), (4,6), and (3,5), then they call that liar. If the other three "fores" are all true, then the probability this is true? (a) Your die is (2,5). An opponent declares that "there be five ones" in all four dice. What is the probability this is true? (b) Your die is (2,5). An opponent declares that "there be six fives" in all four dice. What is the probability this is true?

a) $1/6 \cdot 1/6 \cdot 1/6 \cdot 1/6 = 1/1296 \rightarrow 0.0007716 \approx 0.00077$

b) $1/6 \cdot 1/6 \cdot 1/6 \cdot 1/6 = 1/1296 \rightarrow 0.0007716 \approx 0.00077$

73. Consider a *fair* coin where the probability of a heads, $P(H)$, is 0.5, and the probability of a tails, $P(T)$, is 0.5. Suppose we model the random motion of a gas molecule in 1D like a fair coin, in which movement left is one unit less and movement right is one unit more. Let P_L and P_R be the probability of moving left and right, respectively. Suppose a molecule follows this path: L L L L R R R R. (a) What is the probability that the molecule will follow this path: L L L L R R R R? (b) What is the probability that the molecule will follow this path: R R R R R R R R? (c) Which is more common, a path that leads back to the starting point, or the path in part (b)?

a) $.5^8 = 3.91 \cdot 10^{-5}$

b) $3.91 \cdot 10^{-5}$

c) Both the same, since both have same plausibility

Unit 1

Suppose a stock trader agrees to purchase stock at a certain date, according to a contract that stipulates she must purchase it, regardless of the price. However, she negotiates that the price will be measured into one of four bins that centers the values as shown in Tab. 1. This makes the price a discrete random variable. She performs an analysis that gives the probability that the stock price will fall into each of the categories. If she buys one share, what is the *expected* value of her profit? What would be her profit if she buys 100 shares?

Outcome	x	$p(x)$	$x \cdot p(x)$
Price bin 1	\$90.00 per share	0.01	?
Price bin 2	\$16.00 per share	0.49	?
Price bin 3	-\$15.00 per share	0.49	?
Price bin 4	-\$95.00 per share	0.01	?

Table 1: A table displaying a stock trader's assessment of the probability a stock will fall into one of four bins. (The bin centers are shown).

a) If she buys one share, the expectation value of her profit is \$0.44 per share

b) Her profit after she buys 1000 shares is \$440

2 Unit 0

1. Suppose we measure 10 resting heart rates from 10 college students, during finals, and they've each had coffee. We find: 59, 60, 70, 75, 76, 77, 77, and 78 beats per minute. Provide the following:

- What is the sample size? 10 college students
- What is the mean heart rate? 72.2 beats per minute
- What is the standard deviation of the heart rates? 7.036

Describe one issue with the sample that affects its randomness. How would you get a more complete sample of the student population at Whittier College?
 one issue would be if they only sampled from one class that is taking finals. To get a more complete sample you should randomly survey students from different classes who enroll. See Fig. 1, and copy the data into a spreadsheet, like LibreOffice Calc or Microsoft Excel.

	Accepted	Rejected	Total
2006	2112	1508	3620
2007	2206	1591	3797
Q1	2206	1530	3736
Q2	2206	1538	3744
Q3	2206	1538	3744
Q4	2206	1538	3744
Q5	2206	1538	3744
Q6	2206	1538	3744
Q7	2206	1538	3744
Q8	2206	1538	3744
Q9	2206	1538	3744
Q10	2206	1538	3744
Q11	2206	1538	3744
Q12	2206	1538	3744
Q13	2206	1538	3744
Q14	2206	1538	3744
Q15	2206	1538	3744
Q16	2206	1538	3744
Q17	2206	1538	3744
Q18	2206	1538	3744
Q19	2206	1538	3744
Q20	2206	1538	3744

Figure 1: A table of the number of freshmen who applied, were accepted, and were enrolled in Whittier College, versus year.

- What is the mean number of newly enrolled freshmen per year from 2006 - 2019? 420 students
- Define the acceptance rate as the second column of Fig. 1 divided by the first. What is the average acceptance rate from 2006 to 2019? 68.8%
- What is the standard deviation of the acceptance rate from 2006 - 2019? Are there any outliers? 0.05576
- Graph the time-series of the acceptance rate.

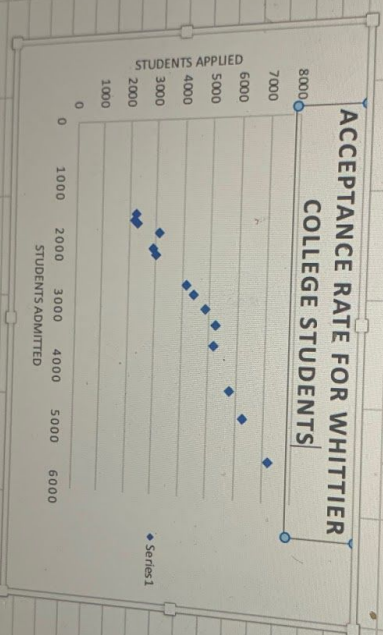
(see picture)

3. In a particular fund, there are 10 stocks, each with the following price per share in USD: 109.00, 108.00, 112.00, 113.00, 113.00, 120.00, 151.00, 170.00, 250.00, and 290.00. (a) What price represents the 75th percentile? (b) To what percentile does 113.00 dollars correspond? (c) What is the standard deviation and mean of the data? (d) Create a histogram of the data. Do you notice skew?

- a) 160.0
 b) Q1
 c) $\sigma = 65.318$
 d) yes, there is a skew towards the right (see picture)

2038	453	2038	2900	0.70275862
2139	427	2139	2993	0.71466756
2622	417	2622	4125	0.63563636
2771	446	2771	4380	0.6326484
3001	388	3001	4850	0.61876289
3267	445	3267	5192	0.62923729
3587	426	3587	5146	0.69704625
4277	520	4277	5773	0.74086264
4724	512	4724	6220	0.75948553
5369	493	5369	7187	0.74704327

10.39864



Sheet1

MacBook

	K	L	M	N	O	P	Q
1	0.09433119		109	190	111.25		
2			108				
3			112				
4			113				
5			113				
6			120				
7			151				
8			170				
9			250				
10			290				
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							
37							
38							
39							
40							
41							

