

1. (15pts) Do this part on your own. Roll two dice 50 times.  
a) Record how many times you get each of the possible sums on the dice in the first row.  
b) In the second row, enter the empirical probabilities for each sum based on your 50 rolls. Then compute the theoretical probabilities for each sum and enter them in the third row of the table. Round everything to 4 decimal points.  
c) Find the difference between the row  $P_E$  and  $P_T$ .

Sum on roll	2	3	4	5	6	7	8	9	10	11	12
Times occurred	0	2	6	5	5	5	10	7	5	2	3
Empirical prob. $P_E$	$\frac{0}{50}$	$\frac{2}{50}$	$\frac{6}{50}$	$\frac{5}{50}$	$\frac{5}{50}$	$\frac{5}{50}$	$\frac{10}{50}$	$\frac{7}{50}$	$\frac{4}{50}$	$\frac{2}{50}$	$\frac{3}{50}$
Theoretical prob. $P_T$	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$
Difference $P_E - P_T$	-0.0278	-0.0156	-0.0389	-0.0111	-0.0389	-0.0667	0.0611	0.0289	-0.0033	-0.0156	0.0322

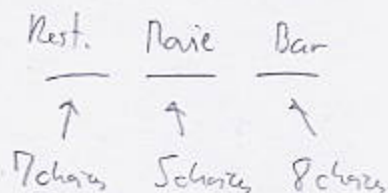
Ex: 6+8 five  
 2,6 }  
 3,5 }  
 4,4 } 5  
 5,3 }  
 6,2 }  
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2. (15pts) Do this part with 3 classmates. Write their names in the space provided. Each of you has to fill in the table independently, but the last three rows of this table should be the same for everyone in your group (check!).  
a) Copy the "Times occurred" line from above into row "You" and do the same for each of your classmates.  
b) Sum by column and enter the sums in the row "Total times occurred".  
c) Compute the empirical probability for each sum on the dice. Keep in mind that your number of experiments is now larger.  
d) Find the difference between the row  $P_E$  and  $P_T$ . Are they smaller than in the table above?

Sum on roll	2	3	4	5	6	7	8	9	10	11	12
You	0	2	6	5	5	5	10	7	5	2	3
Student 1	0	5	4	3	5	12	3	8	3	2	5
Student 2	0	2	2	8	12	7	5	6	5	2	1
Student 3	4	5	5	6	5	4	4	5	4	3	5
Total times occurred	4	14	17	22	27	28	22	26	17	9	14
Empirical prob. $P_E$	$\frac{4}{200}$	$\frac{14}{200}$	$\frac{17}{200}$	$\frac{22}{200}$	$\frac{27}{200}$	$\frac{28}{200}$	$\frac{22}{200}$	$\frac{26}{200}$	$\frac{17}{200}$	$\frac{9}{200}$	$\frac{14}{200}$
Difference $P_E - P_T$	-0.0078	0.0144	0.0017	-0.0011	-0.0389	-0.0267	-0.0289	0.0189	0.0017	-0.0106	0.0422

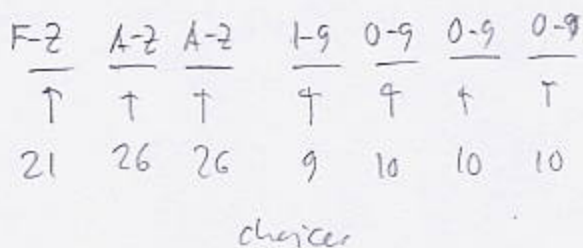
- d) In general, they are smaller (except for columns marked by \*)  
 As the number of experiments increases, empirical probability gets closer and closer to theoretical probability.

3. (8pts) You are planning a night in Nashville with your sweetie, with plans to go to one restaurant, one movie and one bar. If you have seven restaurants to choose from, five movies and eight bars, in how many different ways can you enjoy a night on the town?



$$7 \cdot 5 \cdot 8 = 280$$

4. (10pts) New York state has the following format for car license plates: three letters followed by four numbers, where the first letter cannot be any of the letters A, B, C, D, E, and the first number cannot be a 0. How many different license plates are possible under these rules?



Overall:

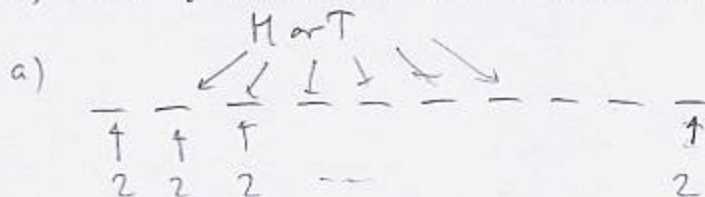
$$21 \cdot 26^2 \cdot 9 \cdot 10^3$$

$$= 1,277,640,000$$

5. (12pts) A coin is tossed 10 times.

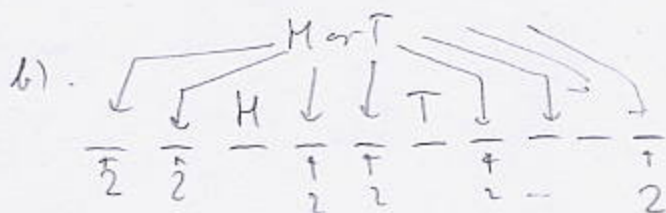
a) How many different outcomes are there to this experiment?

b) How many different outcomes have heads on the third toss and tails on the sixth toss?



choices:

$$\text{overall } \underbrace{2 \cdot 2 \cdot 2 \cdot \dots \cdot 2}_{10 \text{ times}} = 2^{10} = 1024$$



$$\text{overall } \underbrace{2 \cdot 2 \cdot \dots \cdot 2}_{8 \text{ times}} = 2^8 = 256$$