

1. (15pts) Do this part on your own. Roll two dice 50 times.
- Record how many times you get each of the possible sums on the dice in the first row.
 - 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.
 - 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	11 2	11 3	11 11 6	11 2	11 11 5	11 11 11 14	11 11 6	11 11 6	11 3	11 2	1 1
Empirical prob. P_E	$\frac{2}{50}$	$\frac{3}{50}$	$\frac{6}{50}$	$\frac{2}{50}$	$\frac{5}{50}$	$\frac{14}{50}$	$\frac{6}{50}$	$\frac{6}{50}$	$\frac{3}{50}$	$\frac{2}{50}$	$\frac{1}{50}$
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 $P_E - P_T$	0.0122	0.0044	0.0367	-0.0711	-0.0389	0.1133	-0.0189	0.0089	-0.0278	-0.0155	-0.0078

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!).

- Copy the "Times occurred" line from above into row "You" and do the same for each of your classmates.
- Sum by column and enter the sums in the row "Total times occurred".
- Compute the empirical probability for each sum on the dice. Keep in mind that your number of experiments is now larger.
- 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	5 9	13 10	11 8	26 21	44 26	25 42	29 18	13 22	21 18	9 14	4 12
Scores of all 15	7 4	9 12	15 21	23 21	34 30	22 34	28 23	28 27	17 11	13 13	1 4
	5 4	5 8	12 6	15 19	22 22	24 30	17 21	19 14	23 16	7 6	1 5
student groups	3 3	2 10	14 12	30 17	18 20	20 21	15 21	20 11	18 13	6 15	5 7
	7 9	15 18	28 16	16 14	14 14	8 5					
52 students, 2600 rolls	7 4	9 10	20 12	29 24	33 27	38 41	22 21	13 26	15 22	9 8	5 7
	5 2	14 3	15 19	18 17	22 13	45 36	22 29	23 10	17 15	4 5	5 6
	4 4	15 5	17 14	23 11	31 12	27 17	25 11	25 11	13 6	17 7	3 2
Total times occurred	73	134	214	312	382	438	318	276	239	141	72
Empirical prob. P_E	$\frac{73}{2600}$	$\frac{134}{2600}$	$\frac{214}{2600}$	$\frac{312}{2600}$	$\frac{382}{2600}$	$\frac{438}{2600}$	$\frac{318}{2600}$	$\frac{276}{2600}$	$\frac{239}{2600}$	$\frac{141}{2600}$	$\frac{72}{2600}$
Difference $P_E - P_T$	0.0003	-0.0040	-0.0010	0.0089	0.0080	0.0618	-0.0166	-0.0050	0.0086	-0.0013	-0.0001

Because of the large number of experiments, none of these is bigger than the corresponding number above. Thus: the larger the number of experiments, the closer P_E is to P_T .