Mathematical Concepts — Joysheet 5
MAT 117, Spring 2013 — D. Ivanšić

Name: Saul Ocean

Show all your work!

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. Enter these numbers as fractions.
c) Find the difference between the rows P_E and P_T and write it in decimal form rounded to 4 decimal places, ignoring any minus signs (that is what $|\ |$ stands for).

Sum on roll	2	3	4	5	6	7	8	9	10	11	12
Times occured	2	4	3	6	10	6	4	4	5	3	3
Empirical prob. P_E	$\frac{2}{50}$	$\frac{4}{50}$	$\frac{3}{50}$	$\frac{6}{50}$	$\frac{10}{50}$	$\frac{6}{50}$	$\frac{4}{50}$	$\frac{4}{50}$	$\frac{5}{50}$	$\frac{3}{50}$	$\frac{3}{50}$
Theoretical prob. P_T	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$
$\lvert P_E - P_T \rvert$	0.0122	0.0244	0.0233	0.0089	0.0611	0.0467	0.0589	0.0311	0.0167	0.0044	0.0322

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 occured" 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 occured".
c) Write the empirical probability for each sum on the dice as a fraction. Keep in mind that your number of experiments is now larger.
d) Find $|P_E - P_T|$ and write it in decimal form rounded to 4 decimal places. Are the numbers smaller than in the table above?

Sum on roll	2	3	4	5	6	7	8	9	10	11	12
You	2	4	3	6	10	6	4	4	5	3	3
Student 1	1	2	4	6	4	12	9	6	3	2	1
Student 2	0	5	5	6	6	8	6	4	6	0	4
Student 3	0	0	6	7	7	12	3	3	6	4	2
Total times occured	3	11	18	25	27	38	22	17	20	9	10
Empirical prob. P_E	$\frac{3}{200}$	$\frac{11}{200}$	$\frac{18}{200}$	$\frac{25}{200}$	$\frac{27}{200}$	$\frac{38}{200}$	$\frac{22}{200}$	$\frac{17}{200}$	$\frac{20}{200}$	$\frac{9}{200}$	$\frac{10}{200}$
$\lvert P_E - P_T \rvert$	0.0128	0.0006	0.0067	0.0139	0.0389	0.0233	0.0289	0.0261	0.0167	0.0106	0.0222
	⊗	✓	✓	⊗	✓	✓	✓	✓	⊗	⊗	✓

d) In most cases (7 out of 11) $|P_E - P_T|$ is smaller in bottom table than it is in top.

3. (10pts) A certain type of car is sold in seven colors, three trim levels, and you can choose exactly one of four different accessory packages to add to your car (or you may choose not to add an accessory package). If each of the features may be selected independently of the other, how many different car configurations can you buy?

	color	trim	accessory
choices	7	3	5

$7 \cdot 3 \cdot 5 = 105$ possibilities

4. (10pts) Suppose a bank card has nine digits, where the first one is always 5, and the second one cannot be a zero. The last digit is a "check-digit", whose value is number of odd numbers among the remaining digits. (For example, if the first eight digits are 51312547, the ninth digit is 6, since there are 6 odd digits in the group.) How many different bank cards can be issued?

	5	not 0	any	any	any	any	any	any	↓ depends on others
choices	1	9	10	10	10	10	10	10	1

$9 \cdot 10 \cdot 10 \cdots \cdot 10 = 9 \cdot 10^6 = 9{,}000{,}000$ possibilities

5. (10pts) A coin is tossed, then a die is rolled, then a coin is tossed, and then a die is rolled.
a) How many different outcomes are there to this experiment?
b) How many different outcomes have 4 or 5 on the second roll of the die?

a)

	—	—	—	—
choices	2	6	2	6

$2 \cdot 6 \cdot 2 \cdot 6 = 144$ outcomes

b)

	—	—	—	—
	2	6	2	2

$2 \cdot 6 \cdot 2 \cdot 2 = 48$ outcomes