Mathematical Concepts — Joysheet 5
MAT 117, Fall 2012 — D. Ivanšić

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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. 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 occured	0	4	4	6	7	16	4	8	0	1	0
Empirical prob. P_E	$\frac{0}{50}$	$\frac{4}{50}$	$\frac{4}{50}$	$\frac{6}{50}$	$\frac{7}{50}$	$\frac{16}{50}$	$\frac{4}{50}$	$\frac{8}{50}$	$\frac{0}{50}$	$\frac{1}{50}$	$\frac{0}{50}$
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	0.2444	-0.0033	0.0089	0.0111	0.1533	-0.0389	0.0489	-0.0833	-0.0356	-0.0278

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) 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	4	4	6	7	16	4	8	0	1	0
Student 1	1	3	2	9	6	7	9	8	2	1	2
Student 2	1	2	3	6	6	9	5	3	9	4	2
Student 3	1	3	8	4	5	7	6	5	4	4	3
Total times occured	3	12	17	25	24	39	24	24	15	10	7
Empirical prob. P_E	$\frac{3}{200}$	$\frac{12}{200}$	$\frac{17}{200}$	$\frac{25}{200}$	$\frac{24}{200}$	$\frac{39}{200}$	$\frac{24}{200}$	$\frac{24}{200}$	$\frac{15}{200}$	$\frac{10}{200}$	$\frac{7}{200}$
Difference $P_E - P_T$	-0.0128	0.0044	0.0017	0.0139	-0.0189	0.0283	-0.0189	0.0089	-0.0083	-0.0056	-0.0413

d) Generally the numbers $P_E - P_T$ are smaller in table 2.
(Marked where they are bigger by absolute value)

3. (8pts) At a restaurant, you can choose from seven meats, twelve sides and five types of salads. If your idea of a good meat is a combination of a meat with a side and a salad, how many different meals could you order?

meat side salad

$\_\_\_ \quad \_\_\_ \quad \_\_\_$

$7 \quad 12 \quad 5$

choices

overall $7 \cdot 12 \cdot 5 = 420$ meals

4. (10pts) Suppose a bank card has six digits, where the first one cannot be a zero. The sixth digit is a "check-digit", whose value is the remainder of the sum of the first five digits divided by 10. (For example, if the first five digits are 25475, with sum 23, the sixth digit is 3.) How many different bank cards can be issued?

$\_\_\_ \quad \_\_\_ \quad \_\_\_ \quad \_\_\_ \quad \_\_\_ \quad \_\_\_$

$9 \quad 10 \quad 10 \quad 10 \quad 10 \quad 1$

choices

$9 \cdot 10 \cdot 10 \cdot 10 \cdot 10 = 90{,}000$

(may ignore last digit, since it is determined by the others)

5. (12pts) A die is rolled four times.
a) How many different outcomes are there to this experiment?
b) How many different outcomes have a 2 on the third roll?

a) $\_\_\_ \quad \_\_\_ \quad \_\_\_ \quad \_\_\_$

$6 \quad 6 \quad 6 \quad 6$

choices

$6 \cdot 6 \cdot 6 \cdot 6 = 1296$

b) $\_\_\_ \quad 2 \quad \_\_\_ \quad \_\_\_$

$6 \quad 1 \quad 6 \quad 6$

$6 \cdot 6 \cdot 6 = 216$