

(Due Wednesday 09/12/2018 right before class)

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(Your homework shall be stapled if it contains multiple pages.)

### FALL/2018/MA526: HOMEWORK 3

Instructor: Guangqu Zheng<sup>1</sup>; Grader: Chessa Mccalla<sup>2</sup>

**Total points: 20.**

**Q1** (6 points) A pair of fair dice are tossed. Find the probability of getting (1) a total of 8 (2) at most a total 5. Students should specify the sample space  $\Omega$ , the probability  $\mathbb{P}$  on  $\Omega$  and the events that they are asked to consider.

**Q2** (3 points) Bag 1 contains 5 white balls and 4 black balls while Bag 2 contains 3 white balls and 5 black balls. Assume that your eyes have been ALWAYS covered so that you can not distinguish different balls in any of these two bags. One ball was drawn from bag 1 and placed into bag 2. Now you draw a ball from bag 2, then, what is the probability that you get a black ball?

**Q3** (8 points) Pollution of the rivers in the United States has been a problem for many years. Consider the following events:

$A$ : the river is polluted,

$B$ : a sample of water tested detects pollution,

$C$ : fishing is permitted.

Assume  $\mathbb{P}(A) = 0.3$ ,  $\mathbb{P}(B|A) = 0.75$ ,  $\mathbb{P}(B|A^c) = 0.2$ ,  $\mathbb{P}(C|A \cap B) = 0.2$ ,  $\mathbb{P}(C|A^c \cap B) = 0.15$ ,  $\mathbb{P}(C|A \cap B^c) = 0.8$  and  $\mathbb{P}(C|A^c \cap B^c) = 0.9$ , then find (1)  $\mathbb{P}(A \cap B \cap C)$  (2)  $\mathbb{P}(B^c \cap C)$  (3)  $\mathbb{P}(C)$  (4) Find the probability that the river is polluted, given that fishing is permitted and the sample tested did not detect pollution.

**Hint:** Another de-Morgan's law  $(A \cap B)^c = A^c \cup B^c$ .

**Q4** (3 points) Assume that in a family the birth of a boy and a girl is equally likely and that the family has  $n \geq 2$  children. Are the events  $A, B$  defined below independent?

$A = \{\text{There is at least one boy and at least one girl in the family}\}$

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$B = \{\text{There is at most one girl in the family}\}.$

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