EE 520: Random Processes **Fall 2021**

Exercises 1

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The below are in-class exercises designed to help solidify your understanding of the material covered in the notes. They will also aid you in completing some homework problems. Please work together with your group to complete as many of these problems as you can.

PN refers to the online textbook by Pishro-Nik available here. Please do not look at the solutions until after you have completed the problem or received hints from me.

Exercise 1

PN 1.2.5, problem 1

Exercise 2

PN 1.2.5, problem 2

Exercise 3

PN 1.2.5, problem 3

Exercise 4

PN 1.3.6, problem 1

Exercise 5

PN 1.3.6, problem 2

Exercise 6

PN 1.3.6, problem 3

Exercise 7

PN 1.3.6, problem 4

Exercise 8

PN 1.3.6, problem 5

Exercise 9

PN 1.5, problem 3

Exercise 10

PN 1.5, problem 6

Exercise 11

PN 1.5, problem 8

Exercise 12

PN 1.5, problem 9

Exercise 13

Let $A, B \in \mathcal{F}$, where $\mathcal{F}$ is a σ-algebra. Show that $\mathcal{F}$ must contain $A \cap B$, $A \setminus B$, and $A \triangle B$, where $A \triangle B$ denotes the symmetric difference

$$A \triangle B = (A \setminus B) \cup (B \setminus A) = (A \cup B) \setminus (B \cap A).$$

Exercise 14

Assume you know $P(A)$, $P(B)$, and $P(A \cup B)$. Express the following in terms of known quantities.

(a) $P(A \cap B^{\mathsf{c}})$

(b) $P(B \cup (A \cap B^{\mathsf{c}}))$

Exercise 15

Show that if $P(A) \geq 1 - \delta$ and $P(B) \geq 1 - \delta$, then $P(A \cap B) \geq 1 - 2\delta$. This fact shows up *constantly* in papers studying the theory of machine learning.