MA 2621

PROBABILITY FOR APPLICATIONS

TERM A -2017

INSTRUCTOR: Buddika Peiris, PhD (e-mail : tbpeiris@wpi.edu)

LECTURE: MTRF 2.00 -2.50 pm, **OH 107**

OFFICE: SH 100 (phone: 508 831 5940)

OFFICE HOURS: MTRF 10.00-10.50 am (or by appointment)

CONFERENCE:

TA: Li Wenjing

OFFICE: SH 204, e-mail: wli5@wpi.edu, **OFFICE HOURS**: XXXXXXXX.

SECTION C02: W 02.00 – 02.50am, SH 309

SECTION C05: W 01.00 – 01.50am, SH 309

TA: Liu Yang

OFFICE: SH 204, e-mail: yliu22@wpi.edu, **OFFICE HOURS**: XXXXXXXX.

SECTION C01: W 03.00 – 03.50am, SH 309

SECTION C04: W 04.00 – 04.50am, SH 308

PLA: Tran Duc Hong

OFFICE: SH 002, e-mail: dhtran@wpi.edu, **OFFICE HOURS**: XXXXXXXX.

SECTION C03: W 02.00 – 02.50am, OH 223

TEXTBOOKS:

- Elementary Probability for Applications (ISBN 978-0-521-86756-6) by Rick Durrett (2009)
- Introduction to Probability (-GNU Free Document License (FDL)) by Charles M.Grinstead and J.Laurie Snell, 2nd Ed. (2006)

http://www.math.dartmouth.edu/~prob/prob/prob.pdf

ABSTRACT:

- Chapters 1, 2, 3, 5, 6 of Elementary Probability for Applications will be covered (some sections may not be covered).
- Basic probability theory: set algebra, marginal probability, conditional and total probability, Bayes' Rule, independence, and counting.
- Discrete random variables (Binomial, Geometric, and Poisson). Probability mass functions and moments (expectation and variance).

- Continuous random variables (Normal). Probability density functions and cumulative distribution functions. Derived and multivariate distributions.
- Limit theorems: Chebyshev's inequality, law of large numbers, and central limit theorem.

COURSE WEBSITE: https://canvas.wpi.edu/courses/5191

The website is the main platform through which this course will be managed. It contains the syllabus (this document), and lecture notes, announcements, and other course materials. You are responsible for knowing the information in the materials that appear there.

HOMEWORKS:

There will be a homework assignment every week for your benefit and practice - they can also serve as a test of your level of materials being covered in class. Homework will help you to

- Gain a solid understanding of the course material.
- Be creative and think beyond the course material.
- Do better in the exams.

You can informally discuss some problems with your classmates but the final work should be based on your own effort. Please feel free to see me if you have any question.

QUIZZES:

Five fifteen minutes' open book, open note **quiz**zes will be held on Fridays. No electronics are allowed during the quizzes except for a simple calculator. Calculator apps on a smartphone, tablet, kindle, etc are not allowed. You should bring a pocket calculator to each quiz.

EXAMS:

There will be 2 exams based on the material covered until the latest lecture before each. One double-sided **hand written** sheet is allowed for each exam. No electronics are allowed during the exams except for a simple calculator. Calculator apps on a smartphone, tablet, kindle, etc are not allowed. Sample exams will be posted online. No makeup exam will be given unless a student notify me with a legitimate excuse by writing prior to the exam. Makeup exam may be harder than the original exam.

Make sure you do not select classes with conflicting exam dates.

GRADING CRITERIA:

- 6 HWs (20%)
- 5 Quizzes (20%)
- Test-1 (25%)
- Test-2 (35%)

GRADING SCALE:

- A: 90-100 B: 80-89 C: 70-79 NR: below 70.

STUDENTS WITH DISABILITIES:

You should contact the Disabilities Services Office so an appropriate accommodation can be implemented. Please contact dso@wpi.edu or phone x-5235. See me as early as possible in the term so I can address your specific needs.

ACADEMIC HONESTY:

The academic honesty policy can be accessed at: http://www.wpi.edu/Pubs/Policies/Honesty/Students/

TENTATIVE DATES:

Test Dates:

Test-1 T, Sep 19 - Class 15

Test-2 R, Oct 12 - Class 28

HW Due Dates:

HW-1 T, Aug 29 – Class 4

HW-2 T, Sep 05 – Class 7

HW-3 T, Sep 12 – Class 11

HW-4 T, Sep 26 – Class 19

HW-5 T, Oct 03 – Class 23

HW-6 T, Oct 10 – Class 27

Quiz Dates:

Q-1 F, Sep 01 – Class 6

Q-2 F, Sep 08 – Class 9

Q-3 F, Sep 15 – Class 13

Q-4 F, Sep 29 – Class 21

Q-5 F, Oct 06 – Class 25

Chapter – I : Basic concepts

Sec 1.1 : Probability

Defn Random Experiment

Random Experiment is a situation in which we know what outcome could happen, but we don't exactly know which particular outcome will happen, until it happens.

Eg :- 1. tossing a coin
2. Rolling a die
3. Selecting 10 students from MA2621 class. $\binom{175}{10} = {}^{175}C_{10}$

Defn Sample Space [Ω] ← omega

The set of all outcomes of a random experiment.

Eg :- 1. Tossing a coin.

Sample space = $\Omega = \{H, T\}$.

2. Tossing a coin till a head is obtained.

$\Omega = \{H, TH, TTH, TTTH, \ldots\}$.

3. Tossing three coins.

$\Omega = \{HHH, HHT, HTH, THH, HTT, THT, TTH, TTT\}$.

Defn Event

An event is a subset of the sample space.

Eg :- Let $\Omega = \{1, 2, 3, 4, 5, 6\}$.

A - an odd number is obtained $= \{1, 3, 5\}$.

B - number "1" is obtained $= \{1\}$.

Note:

* Usually an event is denoted by a capital letter.
* An event with no outcome is called a "null event" and it is denoted by "ϕ" (↑ pi)

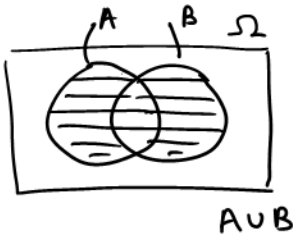
* $x \in A$:- x is an element of event A

* Properties of events

1. Union [$\cup$] $\longrightarrow$ "OR"

$A \cup B = \{$ the outcomes in either A or B (or both)$\}$.

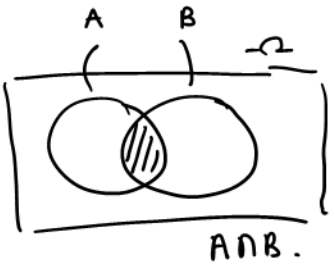
$= \{ x \in \Omega \mid x \in A \text{ or } x \in B \}$



2. Intersection [$\cap$] $\longrightarrow$ "AND"

$A \cap B = \{$ the outcomes in both A and B$\}$

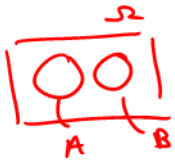
$= \{ x \in \Omega \mid x \in A \text{ and } x \in B \}$.



Defn Axioms of Probability theory

Let $\mathcal{A}$ be the event space (the set of all the events of Ω) of Ω. Then probability assigns to every event $A \in \mathcal{A}$, a number "$P(A)$", called "the probability of event A" satisfying the following axioms.

$$P : A \in \mathcal{A} \longrightarrow P(A) \in [0,1]$$



1) $P(A) \geq 0$ for any event $A \in \mathcal{A}$.

2) If A and B are disjoint ($A \cap B = \emptyset$) then $P(A \cup B) = P(A) + P(B)$.

3) $P(\Omega) = 1$.

Note:

1) $P(\emptyset) = 0$

Proof:

2) If $A_1, A_2, \ldots A_n$ are disjoint then

$$P(A_1 \cup A_2 \cup \cdots \cup A_n) = P(A_1) + P(A_2) + \cdots P(A_n).$$