University of Asia Pacific (UAP)
Department of Computer Science and Engineering (CSE)

Course Outline

Program:	Computer Science and Engineering (CSE)
Course Title:	Mathematics for Computer Science
Course Code:	CSE 401
Semester:	Spring 2023
Level:	7th Semester
Credit Hour:	3.00
Name & Designation of Teacher:	Dr. Shah Murtaza Rashid Al Masud, Associate Professor
Office/Room:	7th floor, CSE Dept.
Class Hours:	**Section A:** Monday 9:30 am-10:50 am (R702), Wednesday 9:30 am-10:50 am (R713) **Section B:** Monday 11:00 am-12:20 pm (R713), Wednesday 2:00 pm-3:20 pm (R713)
Consultation Hours:	Section A: Monday 1:00 pm – 2:00 pm Section B: Wednesday 1:00 pm – 2:00 pm
E-mail:	murtaza@uap-bd.edu
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Rationale:	An essential course to provide the students mathematical knowledge and analytical skills required in computer science, especially for the analysis of algorithms.
Prerequisite (if any)**:**	MTH 203, CSE 207
Course Synopsis:	Recurrent Problems: Tower of Hanoi, Lines in a plane, Josephus Problem Manipulation of Sums: Summand, Reduction of recurrence into sums, Perturbation method, Iversion's Convention

Integer Functions: Floor and Ceiling
Number Theory: Prime numbers, Divisibility
Special Numbers: Stirling number, Fibonacci number, Harmonic numbers
Random Variables: Discrete, Bernoulli, Binomial, Geometric, Poisson, Continuous, Exponential, Gamma, Normal Random Variable
Conditional Probability: The ballot problem, Hat problem, Miner problem
Markov Chain: Chapman–Kolmogorov equations, Limiting Probability, Gambler's Ruin Problem

Course Objectives:

The objectives of this course are to:

1. **Provide** knowledge of mathematical equations and formulas used in computer science
2. **Show** common real-world mathematical problems and how to solve them.
3. **Demonstrate** probabilistic models and how to use them to model real-world scenarios.

Course Outcomes (CO) and their mapping with Program outcomes (PO) and Teaching-Learning Assessment methods:

CO No.	CO Statements: Upon successful completion of the course, students should be able to:	Corresponding POs (Appendix -1)	Bloom's taxonomy domain/level (Appendix-2)	Delivery methods and activities	Assessment Tools
CO1	**Explain** mathematical equations and formulas used in computer science	a	2/ Understand	Lecture, PPT presentation, Group discussion	Quiz, Midterm, Final exam
CO2	**Analyze** complex algorithms using manipulation of sums	b	4/ Analyze	Lecture, PPT presentation, Group discussion	Quiz, Midterm, Final exam
CO3	**Apply** recurrence, manipulation of sums, number theory and probability to **Solve** complex problems	a	3/ Apply	Lecture, PPT presentation, Group discussion	Quiz, Midterm, Final exam
CO4	**Design** solution of complex real-world problems using probabilistic models	c	6/ Create	Lecture, PPT presentation, Group discussion	Quiz, Midterm, Final exam

Weighting COs with Assessment methods:

Assessment Type	% weight	CO1	CO2	CO3	CO4
Final Exam (Written)	**50**	10	10	10	20
Mid Term	**20**	6	7	7	
Quizzes	**30%**	10	10		10
Total	**100%**	26	27	17	30

Course Content Outline and mapping with COs

Weeks	Topics / Content	Course Outcome	Delivery methods and activities	Reading Materials
1-2	Recurrent Problems: Tower of Hanoi, Lines in a plane, Josephus Problem	CO1, CO3	Lecture, PPT presentation, Problem solving, group discussion	● Concrete Mathematics: A Foundation for Computer Science, Chapter: 1 ● Slides provided in the class
3-4	Manipulation of Sums: Sums and recurrences, General Methods	CO1, CO2	Lecture, PPT presentation, Problem solving, group discussion	● Concrete Mathematics: A Foundation for Computer Science, Chapter: 2 ● Slides provided in the class
5-6	Integer Functions: Floor/ Ceiling, Recurrence, Sums	CO1, CO3	Lecture, PPT presentation, Problem solving, group discussion	● Concrete Mathematics: A Foundation for Computer Science, Chapter: 3
7	Number Theory: Prime Numbers, Special Numbers, Stirling numbers	CO1, CO3	Lecture, PPT presentation, Problem solving, group discussion	● Concrete Mathematics: A Foundation for Computer Science, Chapter: 4, 6
8	Introduction to probability	CO1	Lecture, PPT presentation, Problem solving, group discussion	● Introduction to Probability Models, Chapter: 1 ● Slides provided in the class

9-10	Random Variables(RV): Discrete, Bernoulli, Binomial, Geometric, Poisson, Continuous, Exponential, Gamma, Normal RV and their expectation, variance	CO1, CO3, CO4	Lecture, PPT presentation, Problem solving, group discussion	● Introduction to Probability Models, Chapter: 2
11-12	Conditional Probability and their expectation and variance	CO1, CO3, CO4	Lecture, PPT presentation, Problem solving, group discussion	● Introduction to Probability Models, Chapter: 3
13-14	Markov Chain: Chapman–Kolmogorov equations, Limiting Probability, Gambler's Ruin Problem	CO1, CO4	Lecture, PPT presentation, Problem solving, group discussion	● Introduction to Probability Models, Chapter: 4

Required Reference(s): **1. Concrete Mathematics: A Foundation for Computer Science** by Ronald Graham, Donald Knuth, and Oren Patashnik. 2nd Edition, Addison-Wesley Professional

2. Introduction to Probability Models by Sheldon M. Ross

Recommended Reference(s): The Art of Computer Programming, Volume 1 and 2 by Donald E**.** Knuth,Third Edition, Addison-Wesley.

Special Instructions:

- Minimum Required Attendance: 70%
- Students must come to class prepared for the course material covered in the previous class
- Students must submit their assignments on time. No late or partial assignments will be acceptable.

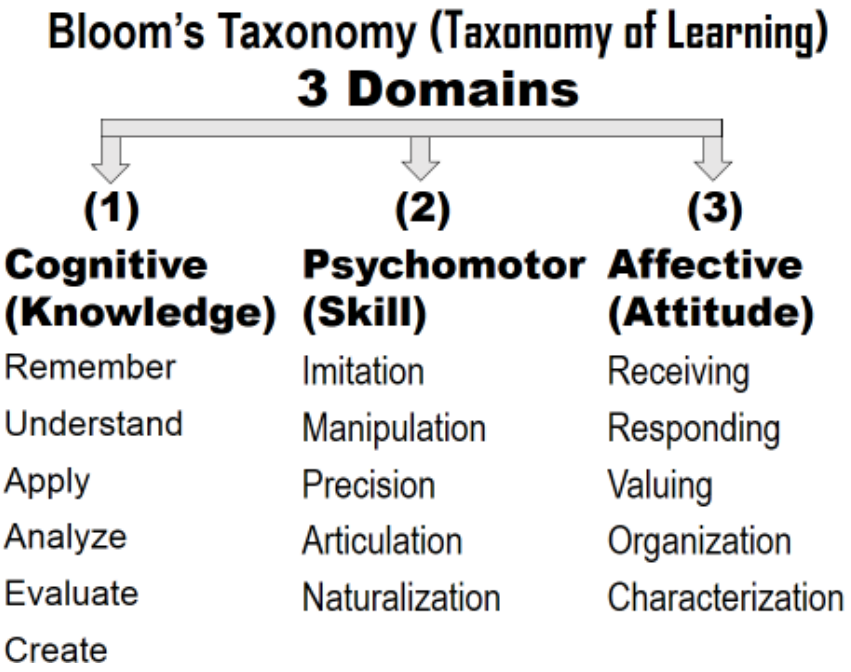
Prepared by	Checked by	Approved by
Dr.Shah Murtaza Rashid Al Masud (SHM)	Chairman, PSAC committee	Head of the Department

Appendix-1:

Washington Accord Program Outcomes (PO) for engineering programs:

No.	PO Statement
PO (a)	Apply knowledge of mathematics, natural science, engineering fundamentals and an engineering specialization as specified in K1 to K4 respectively to the solution of complex engineering problems.
PO (b)	Identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences. (K1 to K4)
PO (c)	Design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations. (K5)
PO (d)	Conduct investigations of complex problems using research-based knowledge (K8) and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions.
PO (e)	Create, select and apply appropriate techniques, resources and modern engineering and IT tools, including prediction and modeling, to complex engineering activities with an understanding of their limitations. (k6)
PO (f)	Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solutions to complex engineering problems. (K7)
PO (g)	Understand and evaluate the sustainability and impact of professional engineering work in the solution of complex engineering problems in societal and environmental contexts. (K7)
PO (h)	Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice. (K7)
PO (i)	Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
PO (j)	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO (k)	Demonstrate knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO (l)	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Appendix-2



Appendix-3

UAP Grading Policy:

Numeric Grade	Letter Grade	Grade Point
80% and above	A+	4.00
75% to less than 80%	A	3.75
70% to less than 75%	A-	3.50
65% to less than 70%	B+	3.25
60% to less than 65%	B	3.00
55% to less than 60%	B-	2.75
50% to less than 55%	C+	2.50
45% to less than 50%	C	2.25
40% to less than 45%	D	2.00
Less than 40%	F	0.00