**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:** Fall 2020

**Level:** 4th year 1st Semester

**Credit Hour:** 3.00

**Name & Designation of Teacher:** Hasan Murad (HMD), Lecturer

**Office/Room:** 7th floor, UAP

**Class Hours:** Mon 11:00am-12:20pm (A), Thu 17:00pm-18:20pm (A)

Mon 09:30am-10:50am (B), Tue 15:30pm-16:50pm (B)

**Consultation Hours:**

**E-mail:** hasanmurad.cse@uap-bd.edu

**Mobile:** +8801826538099 (HMD)

**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 | 1 | 1/ Understand | Live /recorded video lecture, PPT presentation | Written short question  Using Google form, Oral Exam |
| CO2 | **Analyze** complex algorithms using manipulation of sums | 2 | 1/ Analyze | Live /recorded video lecture, PPT presentation | Written short question  Using Google form, Open Book Exam |
| CO3 | **Apply** recurrence, manipulation of sums, number theory and probability to **Solve** complex problems | 3 | 1/ Apply | Live /recorded video lecture, PPT presentation | Individual Assignments,Open Book Exam |
| CO4 | **Design** solution of complex real-world problems using probabilistic models | 3 | 1/ Apply | Live /recorded video lecture, PPT presentation | Individual Assignments,Open Book Exam |

**Weighting COs with Assessment methods:**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Assessment**  **Type** | **% weight** | **CO1** | **CO2** | **CO3** | **CO4** |
| Final Exam (Written) | **40%** |  |  | 20 | 20 |
| Final Exam (Viva) | **10%** | 10 |  |  |  |
| Mid Term | **20%** |  | 6.67 | 13.33 |  |
| Open book  exam, Assignment | **20%** |  |  | 10 | 10 |
| Class performance, Quizzes | **10%** | 10 |  |  |  |
| **Total** | **100%** | 20 | 6.67 | 43.33 | 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 | Live /recorded video lecture, PPT presentation | ● 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 | Live /recorded video lecture, PPT presentation | ● Concrete Mathematics: A  Foundation for Computer  Science, Chapter: 2  ● Slides provided in the  class |
| 5-6 | Integer Functions: Floor/  Ceiling, Recurrence, Sums | CO1, CO3 | Live /recorded video lecture, PPT presentation | ● Concrete Mathematics: A  Foundation for Computer  Science, Chapter: 3 |
| 7 | Number Theory: Prime  Numbers, Special Numbers, Stirling numbers | CO1, CO3 | Live /recorded video lecture, PPT presentation | ● Concrete Mathematics: A  Foundation for Computer  Science, Chapter: 4, 6 |
| 8 | Introduction to probability | CO1 | Live /recorded video lecture, PPT presentation | ● 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 | Live /recorded video lecture, PPT presentation | ● Introduction to Probability Models, Chapter: 2 |
| 11-12 | Conditional Probability and their expectation and  variance | CO1, CO3, CO4 | Live /recorded video lecture, PPT presentation | ● Introduction to Probability Models, Chapter: 3 |
| 13-14 | Markov Chain:  Chapman–Kolmogorov  equations, Limiting  Probability, Gambler’s Ruin Problem | CO1, CO4 | Live /recorded video lecture, PPT presentation | ● 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.

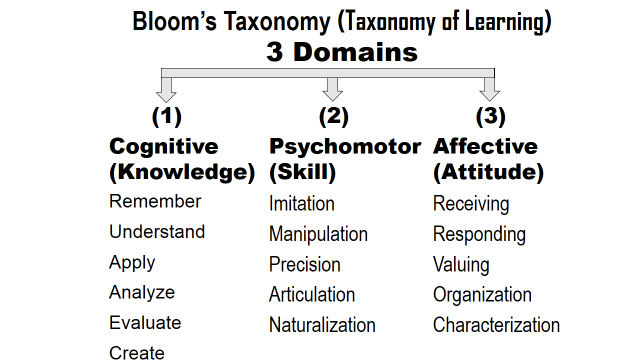
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| **Prepared by** | **Checked by** | **Approved by** |
| Hasan Murad (HMD) | Chairman, PSAC committee | Head of the Department |

**Appendix-1:**

**Washington Accord Program Outcomes (PO) for engineering programs:**

|  |  |  |
| --- | --- | --- |
| **No.** | **PO** | **Differentiating Characteristic** |
| 1 | Engineering Knowledge | Breadth and depth of education and type of knowledge, both theoretical and practical |
| 2 | Problem Analysis | Complexity of analysis |
| 3 | Design/ development of solutions | Breadth and uniqueness of engineering problems i.e. the extent to which problems are original and to which solutions have previously been identified or codified |
| 4 | Investigation | Breadth and depth of investigation and experimentation |
| 5 | Modern Tool Usage | Level of understanding of the appropriateness of the tool |
| 6 | The Engineer and Society | Level of knowledge and responsibility |
| 7 | Environment and Sustainability | Type of solutions. |
| 8 | Ethics | Understanding and level of practice |
| 9 | Individual and Team work | Role in and diversity of team |
| 10 | Communication | Level of communication according to type of activities performed |
| 11 | Project Management and Finance | Level of management required  for differing types of activity |
| 12 | Lifelong learning | Preparation for and depth of Continuing learning. |

**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 |