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|  | **East West University**  **Department of Computer Science and Engineering**  **Course Outline**  **Spring 2018 Semester** |  |

**Course Information**

**Course: CSE207 Data Structures**

**Credit and Teaching Scheme:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Theory | Laboratory | Total |
| Credits | 3 | 1 | 4 |
| Contact Hours | 3 Hours/Week for 13 Weeks | 2 Hours/Week for 13 Weeks | 5 Hours/Week for 13 Weeks |

**Prerequisite:** CSE205 Discrete Mathematics

**Instructor Information**

**Instructor:** Tanni Mittra

Lecturer, Department of Computer Science and Engineering

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**TA:** TBA

**Class Routine and Office Hour**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Days** | 10:10-11:40 | 11:50-01:20 | 01:30-03:00 | 03:10-04:40 | 04:50-06:50 |
| **Sunday** | CSE 207 LAB(3)  Room # : 630 ( SE Lab) | *Office Hour* |  |  |  |
| **Monday** | CSE207(4)  Room # : 111 | *Office Hour* |  |  |  |
| **Tuesday** | CSE207( 3)  Room #: 358 | *Office Hour* |  | *Office Hour* | CSE 207 LAB(4)  Room # : 630 ( SE Lab) |
| **Wednesday** | CSE207( 4)  Room # : 111 | *Office Hour* |  | *Office Hour* |  |
| **Thursday** | CSE207( 3)  Room #: 107 | *Office Hour* | *Office Hour* |  |  |

**Course Objective**

The course develops students' skills for designing and analyzing linear and non-linear data structures. It strengthens students' ability to identify and apply the suitable data structure for solving real world problems. Knowledge of this course will be needed as prerequisite knowledge for future courses such as CSE246 Algorithms, CSE366 Artificial Intelligence, CSE405 Computer Networks, CSE 471 Compiler Design.

**Course Outcomes (COs)**

After completion of this course students will be able to:

|  |  |
| --- | --- |
| CO1 | **Understand** and **apply** basic data structures for storage and retrieval of ordered and unordered data. |
| CO2 | **Implement** and **characterize** algorithms for creation and manipulation of data structures like stacks, queues, linked list, etc. |
| CO3 | **Interpret** and **apply** appropriate data structures for implementing problem solving algorithms such as searching, insertion, deletion, traversing mechanism, etc., on various data structures. |
| CO4 | **Compute** and **Characterize** the efficiency of data structures for complex problem-solving algorithms; **perform** and **demonstrate** this knowledge and **write** report for realistic problem solving. |

**Mapping of Course Outcomes (COs) to Program Outcomes (POs)**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| CO1 | X |  |  |  |  |  |  |  |  |  |  |  |
| CO2 | X |  | X |  |  |  |  |  |  |  |  |  |
| CO3 | X | X | X |  |  |  |  |  |  |  |  |  |
| CO4 | X | X | X |  |  |  |  |  | X | X |  | X |

**Descriptions of Program Outcomes (POs)**

|  |  |
| --- | --- |
| PO1 | **Engineering Knowledge (Cognitive):** Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems. |
| PO2 | **Problem Analysis (Cognitive):** Identify, formulate, research the literature and analyze complex engineering problems and reach substantiated conclusions using first principles of mathematics, the natural sciences and the engineering sciences. |
| PO3 | **Design/Development of Solutions (Cognitive, Affective):** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for public health and safety as well as cultural, societal and environmental concerns. |
| PO4 | **Investigation (Cognitive, Psychomotor):** Conduct investigations of complex problems, considering design of experiments, analysis and interpretation of data and synthesis of information to provide valid conclusions. |
| PO5 | **Modern Tool Usage (Psychomotor, Cognitive):** 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 the limitations. |
| PO6 | **The Engineer and Society (Affective):** Apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice. |
| PO7 | **Environment and Sustainability (Affective, Cognitive):** Understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of, and need for sustainable development. |
| PO8 | **Ethics (Affective):** Apply ethical principles and commit to professional ethics, responsibilities and the norms of the engineering practice. |
| PO9 | **Individual Work and Teamwork (Psychomotor, Affective):** Function effectively as an individual and as a member or leader of diverse teams as well as in multidisciplinary settings. |
| PO10 | **Communication (Psychomotor, Affective):** Communicate effectively about complex engineering activities with the engineering community and with society at large. Be able to comprehend and write effective reports, design documentation, make effective presentations and give and receive clear instructions. |
| PO11 | **Project Management and Finance (Cognitive, Psychomotor):** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work as a member or a leader of a team to manage projects in multidisciplinary environments. |
| PO12 | **Life-Long Learning (Affective, Psychomotor):** Recognize the need for and have the preparation and ability to engage in independent, life-long learning in the broadest context of technological change. |

**Complex Engineering Problems and Activities**

**Attributes of Complex Engineering Problems Involved**

|  |  |  |
| --- | --- | --- |
| CO | PO | Attributes |
| CO1 | PO1 | Range of conflicting requirements, familiarity of issues |
| CO2 | PO1, PO3 | Range of conflicting requirements, familiarity of issues |
| CO3 | PO1, PO2, PO3 | Range of conflicting requirements, familiarity of issues |
| CO4 | PO1, PO2, PO3 | Range of conflicting requirements, depth of analysis required, depth of knowledge required, familiarity of issues |

**Attributes of Complex Engineering Activities Involved**

|  |  |  |
| --- | --- | --- |
| CO | PO | Attributes |
| CO4 (Assignment) | PO10 | Range of resources, Level of interaction, Familiarity |
| CO4 (Mini Project) | PO10 | Range of resources, Level of interaction, Familiarity |

**Descriptions of Range of Complex Engineering Problem Solving**

|  |  |
| --- | --- |
| **Attribute** | **Complex Problems** |
| Range of conflicting requirements | Involve wide-ranging or conflicting technical, engineering and other issues |
| Depth of analysis required | Have no obvious solution and require abstract thinking and originality in analysis to formulate suitable models. |
| Depth of knowledge required | Requires research-based knowledge, much of which is at, or informed by, the forefront of Computer Science and Engineering and that allows a fundamental-based, first-principles analytical approach. |
| Familiarity of issues | Involve infrequently encountered issues. |
| Extent of applicable codes | Are outside problems encompassed by standards and codes of practice for professional Computer Science and Engineering. |
| Extent of stakeholder involvement and level of conflicting requirements | Involve diverse groups of stakeholders with widely varying needs. |
| Consequences | Have significant consequences in a range of contexts. |
| Interdependence | Are high-level problems that include many component parts or sub-problems. |

**Descriptions of Range of Complex Engineering Activities**

|  |  |
| --- | --- |
| **Attribute** | **Complex Problems** |
| Range of resources | Involve the use of diverse resources (for this purpose, resources include people, money, equipment, materials, information and technologies) |
| Level of interaction | Require resolution of significant problems arising from interactions between wide-ranging or conflicting technical, engineering or other issues |
| Innovation | Involve creative use of Computer Science and Engineering principles and research-based knowledge in novel ways |
| Consequences to society and the environment | Have significant consequences in a range of contexts, characterized by difficulty of prediction and mitigation |
| Familiarity | Outside problems encompassed by standards and codes of practice for professional Computer Science and Engineering |

**Course Topics, Teaching-Learning Method, and Assessment Scheme**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Course Topic** | T**eaching-Learning Method** | **CO** | **Mark of Cognitive Learning Levels** | | | **Mark of Psycho-motor Learning Levels** | | **Mark of Affective Learning Levels** | **CO**  **Mark** | **Exam**  **(Mark)** |
| **C2** | **C3** | **C4** | **P2** | **P3** | **A2** |
| Pointers, Structures, dynamic memory allocation and Abstract Data Type | Lecture, Class Discussion, Discussion Outside Class with Instructor/ TeachingAssistant | CO1 | 2 |  |  |  |  |  | 2 | Midterm Exam I  (15) |
| Linked List Implementation and its application |  | CO1 |  | 3 |  |  |  |  | 3 |
| Stack Implementation and its Application | Do | CO2 |  | 5 |  |  |  |  | 5 |
| Queue Implementation and its Application | Do | CO2 |  | 5 |  |  |  |  | 5 |
| Iterative Solution and Recursive Solution design | Do | CO1 | 3 |  |  |  |  |  | 3 | Midterm Exam II  (20) |
| Basic Tree Concepts, Tree Traversals, Binary Trees and their applications | Do | CO2 | 3 |  |  |  |  |  | 3 |
| Binary Search Trees, Insert, Delete, Search and Traversal Algorithms | Do | CO3 |  | 7 |  |  |  |  | 7 |
| AVL Tree | Do | CO3 |  | 7 |  |  |  |  | 7 |
| Binary Heap and Priority queue | Do | CO4 |  |  | 5 |  |  |  | 5 | Final Exam  (20) |
| Graph representation, Terminology, Graph traversal techniques | Do | CO4 | 2 | 3 |  |  |  |  | 5 |
| Spanning Tree, MST, Shortest Path Problem | Do | CO4 |  |  | 5 |  |  |  | 5 |
| **Hashing: Methods, Hashed Search** | Do | CO3 |  | 5 |  |  |  |  | 5 |

**Laboratory Experiments/Project, Teaching-Learning Method, and Assessment Scheme:**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Experiment** | **Teaching-Learning Method** | **CO** | **Mark of Cognitive Learning Levels** | | **Mark of Psycho-motor Learning Levels** | | **Mark of Affective Learning Levels** | **CO**  **Mark** |
| C3 | C4 | P2 | P3 | A2 |  |
| Implementation of different operations on linked list – copy, concatenate, split, reverse, count no. of nodes etc. | Preparing Pre-Lab Report, Lab Experiment and Result Analysis, Preparing Post-Lab Report | CO2 | 1 | 1 |  |  |  | 2 |
| Implementations of stack menu driven program. | Do | CO2 | 1 | 1 |  |  |  | 2 |
| Implementations of queue menu driven program. | Do | CO2 | 1 | 1 |  |  |  | 2 |
| Implementations of BST program. | Do | CO3 | 1 | 1 |  |  |  | 2 |
| Implementations of Binary heap program. | Do | CO3 | 1 | 1 |  |  |  | 2 |
| Implementations of minimum spanning tree using Prim’s or Kruskal’s algorithm or  Implementations of Graph menu driven program (BFS & DFS). | Do | CO3 | 1 | 1 |  |  |  | 2 |
| Lab Exam | Individual Lab Exam | CO2CO4 | 3 | 3 |  |  |  | 6 |
| Mini Project including Report and Presentation | Team-based moderately complex Lab Project with report writing, and oral/poster presentation | CO4 | 2 | 2 | 1 | 1 | 1 | 7 |
| **Total** |  |  | **9** | **12** | **2** | **2** |  | **25** |

**Assignments**

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Course Topic | Teaching-Learning Method | CO | Mark of Cognitive Learning Levels | | Mark of Psycho-motor Learning Levels | | Mark of Affective Learning Levels | CO Mark | Exam (Mark) |
| C2 | C3 | P2 | P3 | A2 |
| Assignments with reports and presentations\* | Group-based or Individual, moderately complex programming assignments with report writing and oral or poster presentation | CO1  CO2 | 0.5  0.5 | 0.5  0.5 | 0.5  0.5 | 0.5  0.5 | 0.5  0.5 | 5 | Assign-ment  (5) |

**\*Notes:**

* **Late assignments suffer a penalty rate of 20% per day, up to 5 days (weekends count towards the 5 days).** Assignments that are more than 5 days late are penalized by 100%.
* Group-based assignment must be done in group of 3.
* **STRICTLY NO COPYING** from others.

**Descriptions of Cognitive Domain (Anderson and Krathwohl’s Taxonomy 2001):**

The **cognitive domain** involves the development of our mental skills and the acquisition of knowledge.

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| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Keywords** |
| C1 | Remembering | Recognizing or recalling knowledge from memory. Remembering is when memory is used to produce or retrieve definitions, facts, or lists, or to recite previously learned information. | Define, describe, draw, find, identify, label, list, match, name, quote, recall, recite, tell, write |
| C2 | Understanding | Constructing meaning from different types of functions be they written or graphic messages or activities like interpreting, exemplifying, classifying, summarizing, inferring, comparing, or explaining. | Classify, compare, exemplify, conclude, demonstrate, discuss, explain, identify, illustrate, interpret, paraphrase, predict, report |
| C3 | Applying | Carrying out or using a procedure through executing, or implementing. *Applying* relates to or refers to situations where learned material is used through products like models, presentations, interviews or simulations. | Apply, change, choose, compute, dramatize, implement, interview, prepare, produce, role play, select, show, transfer, use |
| C4 | Analyzing | Breaking materials or concepts into parts, determining how the parts relate to one another or how they interrelate, or how the parts relate to an overall structure or purpose. Mental actions included in this function are *differentiating, organizing, and attributing,* as well as*being able to distinguish between* the components or parts. When one is analyzing, he/she can illustrate this mental function by creating spreadsheets, surveys, charts, or diagrams, or graphic representations. | Analyze, characterize, classify, compare, contrast, debate, deconstruct, deduce, differentiate, discriminate, distinguish, examine, organize, outline, relate, research, separate, structure |
| C5 | Evaluating | Making judgments based on criteria and standards through checking and critiquing. Critiques, recommendations, and reports are some of the products that can be created to demonstrate the processes of evaluation. | Appraise, argue, assess, choose, conclude, critique, decide, evaluate, judge, justify, predict, prioritize, prove, rank, rate, select, monitor |
| C6 | Creating | Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing. Creating requires users to put parts together in a new way, or synthesize parts into something new and different creating a new form or product.  This process is the most difficult mental function. | Construct, design, develop, generate, hypothesize, invent, plan, produce, compose, create, make, perform, plan, produce |

**Descriptions of Psychomotor Domain (Dave’s Taxonomy 1975):**

The **psychomotor domain** includes physical movement, coordination, and use of the motor-skill areas.

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| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Keywords** |
| P1 | Imitation | Copy action of another; observe and replicate. | Relate, Repeat, Choose, Copy, Follow, Show, Identify, Isolate. |
| P2 | Manipulation | Reproduce activity from instruction or memory | Copy, response, trace, Show, Start, Perform, Execute, Recreate. |
| P3 | Precision | Execute skills reliably; independent of help. | Assemble, Implement, Organize, Calibrate, Demonstrate, Build, Perfect, Control, Complete, Measure. |
| P4 | Articulation | Adapt and integrate expertise to satisfy a non-standard objective. | Modify, Master, Develop, Adapt, Formulate, Coordinate, Combine, Solve, Integrate. |
| P5 | Naturalization | Automated, unconscious mastery of activity and related skills at strategic level. | Design, Rank, Manage, Compose, Develop, Specify, Construct, Invent. |

**Descriptions of Affective Domain (Krathwohl, Bloom, Masia’s Taxonomy 1973):**

The **affective domain** includes the manner in which we deal with things emotionally, such as feelings, values, appreciation, enthusiasms, motivations, and attitudes.

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| --- | --- | --- | --- |
| **Level** | **Category** | **Meaning** | **Keywords** |
| A1 | Receiving | Willingness to participate in an activity to attend to a stimulus; getting and holding the attention of students. | Locate, Give, Point to, Follow, Sit erect, Hold, Name, reply, Identify, Choose |
| A2 | Responding | Actively participates; demonstrates interest in an object, activity or phenomena; seeks or pursues this object, activity or phenomena. | Label, Answer, Perform, Write, Conform, Assist, Recite, Report, Read, Greet, Help, Present, Compile. |
| A3 | Valuing | Value or worth attached to an object, activity or phenomena; varies from simple acceptance to commitment. | Work, Form, Follow, Join, Invite, Justify, Study, Explain, Share, Propose, Select, Complete, Describe, read, report, Differentiate, Initiate. |
| A4 | Organizing | Compare and contrast, and resolve conflict to build a consistent value system; emphasis on comparing and synthesizing values. | Relate, Synthesize, Identify, Prepare, Defend, Generalize, Modify, Integrate, Order, Compare, Complete, Organize, Adhere, Arrange, Combine, Explain, Alter. |
| A5 | Internalizing | Adopt a value system for a length of time that contributes to a particular “lifestyle” (i.e. directs behavior). | Influence, Propose, Use, Quality, Revise, Serve, Solve, Modify, Display, Practice, Listen, Question, Perform, Act, Discriminate, Verify |

**Overall Assessment Scheme**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **CO** | | | | **Assessment Area Mark** |
| **Assessment Area** | **CO1** | **CO2** | **CO3** | **CO4** |  |
| Class Participation | 2 | 1 | 1 | 1 | 05 |
| Class Test/Quiz | 4 | 2 | 2 | 2 | 10 |
| Midterm Exam - I | 5 |  | 10 |  | 15 |
| Midterm Exam -II | 3 | 3 | 14 |  | 20 |
| Final Exam |  |  | 5 | 15 | 20 |
| Assignments with reports | 3 | 2 |  |  | 05 |
| Laboratory Experiments, Exam, and Mini Project |  | 10 | 6 | 9 | 25 |
| **Total Mark** | **17** | **18** | **38** | **27** | **100** |

**Teaching Materials/Equipment**

**Text Book**

* Data Structure – A Pseudocode Approach with C - Richard F. Gilberg, BehrouzA. Forouzan.

**References**

* Data Structures and Algorithms – Alfred V. Aho, Jeffrey D. Ullman and John E.Hopcroft
* Introduction to Algorithms - Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

**Assignment:**

Assignment description will be provided.

**Lab Manual:**

Lab manual will be provided.

**Project Description:**

Project description will be provided.

**Equipment/Software:**

Any C/C++ IDE: As example, Visual C++, Code::Block, and/or Dev-C++

**Exam Dates**

|  |  |  |  |
| --- | --- | --- | --- |
| **Section** | **Term I** | **Term II** | **Final** |
| 3 | 11.02.2018 | 11.03.2018 | 15.04.2018 |
| 4 | 07.02.2018 | 07.03.2018 | 11.04.2018 |

**Grading System**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Marks (%)** | **Letter Grade** | **Grade Point** | **Marks (%)** | **Letter Grade** | **Grade Point** |
| 97-100 | A+ | 4.00 | 73-76 | C+ | 2.30 |
| 90-96 | A | 4.00 | 70-72 | C | 2.00 |
| 87-89 | A- | 3.70 | 67-69 | C- | 1.70 |
| 83-86 | B+ | 3.30 | 63-66 | D+ | 1.30 |
| 80-82 | B | 3.00 | 60-62 | D | 1.00 |
| 77-79 | B- | 2.70 | Below 60 | F | 0.00 |

**Academic Code of Conduct**

**Academic Integrity:**

Any form of cheating, plagiarism, personification, falsification of a document as well as any other form of dishonest behavior related to obtaining academic gain or the avoidance of evaluative exercises committed by a student is an academic offence under the Academic Code of Conduct and **may lead to severe penalties as decided by the Disciplinary Committee of the university.**

**Special Instructions:**

* Students are expected to attend all classes and examinations. A student MUST have at least 80% class attendance to sit for the final exam.
* Students will not be allowed to enter into the classroom after 20 minutes of the starting time.
* For plagiarism, the grade will automatically become zero for that exam/assignment.
* Normally there will be **NO make-up exam**. However, in case of **severe illness, death of any family member, any family emergency, or any humanitarian ground**, if a student miss any exam, the student MUST get approval of makeup exam by written application to the Chairperson through the Course Instructor **within 48hours**of the exam time. Proper supporting documents in favor of the reason of missing the exam have to be presented with the application.
* For **final exam**, there will be NO makeup exam. However, in case of **severe illness, death of any family member, any family emergency, or any humanitarian ground**, if a student miss the final exam, the student MUST get approval of **Incomplete Grade** by written application to the Chairperson through the Course Instructor **within 48 hours**of the final exam time. Proper supporting documents in favor of the reason of missing the final exam have to be presented with the application. **It is the responsibility of the student to arrange an Incomplete Exam within the deadline mentioned in the Academic Calendar in consultation with the Course Instructor**.
* All mobile phones MUST be turned to silent mode during class and exam period.
* There is **zero tolerance for cheating**in exam. Students caught with cheat sheets in their possession, whether used or not;writing on the palm of hand, back of calculators, chairs or nearby walls; copying from cheat sheets or other cheat sources; copying from other examinee, etc. would be treated as cheating in the exam hall. The only penalty for cheating is **expulsion for several semesters as decided by the Disciplinary Committee of the university**.