**University of Asia Pacific (UAP)**

**Department of Computer Science and Engineering (CSE)**

**Course Outline**

**Program:** Computer Science and Engineering (CSE)

**Course Title:** Data Structure

**Course Code:** CSE 205

**Semester:** Fall-2017

**Level:** 3rd Semester

**Credit Hour:** 3.0

**Name & Designation of Teacher:** Dr. Bilkis Jamal Ferdosi, Associate Professor

**Office/Room: 701 (B),** 7th Floor, teacher’s compound

**Class Hours:** SECTION A: Sunday, 11:00am – 12:20pm

Monday, 11:00am – 12:20pm

SECTION B: Sunday, 12:30pm – 1:50 pm

Tuesday, 11:00am – 12:20pm

SECTION C: Wednesday, 2:00pm – 3:20pm

Thursday, 11:00am – 12:20pm

**Consultation Hours:** Monday 1pm – 3pm – Sec A

Tuesday 1pm – 3pm – Sec B

Wednesday 11am – 1:00 pm – Sec C

**e-mail:** bjferdosi@uap-bd.edu

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**Rationale:** (a set of reasons or a logical basis for a course of action or a particular belief. )

Required course and a pre-requisite to CSE 207 Algorithms, CSE 313 Numerical Methods. The knowledge of Data Structure is very important for the field of Computer Programming.

**Pre-requisite** (if any)**:** CSE 101, CSE103, CSE 105

**Course Synopsis:**

Concepts & example: Introduction to data structures. Elementary data structures: Arrays, records, pointers. Arrays: Types, memory, representation and operations with arrays. Linked lists: Representation types and operation of linked list, Stacks and Queues: Implementations, operations with stacks and queues. Graphs: Implementations, operations with graphs. Trees: Representations, types operations with trees. Memory Management: Uniform size records, diverse size records. Sorting: Internal sorting, external sorting. Searching: Array and List searching, tree searching. Hashing: Hashing functions, collision resolution.

**Course Objectives (CO):** The objectives of this course are:

1. To teach efficient storage mechanisms of data for an easy access.
2. To impart the basic concepts of data structures and fundamental operations on them.
3. To design and implementation of various basic and advanced data structures.
4. To develop applications using data structures.

**Learning Outcomes (LO):** Upon completion of the course, the students will be able to:

(See list of action verbs for LO)

1. Define basic static and dynamic data structures and relevant standard algorithms for them: stack, queue, dynamically linked lists, trees, graphs, heap, priority queue, hash tables, sorting algorithms
2. Demonstrate advantages and disadvantages of specific data structures
3. Student will be able to choose appropriate data structure as applied to specified problem definition.
4. Student will be able to handle operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.
5. Student will be able to develop applications using data structures

**Teaching-learning and Assessment Strategy:** Lectures, assignments, quizzes, exams

**Linkage of LO with Assessment Methods & their Weights:**

|  |  |  |
| --- | --- | --- |
| **LO** | **Assessment Method** | **(%)** |
|  |  |  |
| 1 – 3 | Quiz | 10 |
| 1 – 6 | Class attendance | 10 |
| 4,5,6 | Assignment | 10 |
| 1– 4 | Midterm Exam | 20 |
| 1 – 6 | Final Exam | 50 |

**Minimum attendance:** 70% class attendance is mandatory for a student in order to appear at the final examination.

**Mapping of Course LO and Generic Skills:**

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Learning Outcome (LO) of the Course** | **Generic Skills\* (Appendix-1)** | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Define** basic static and dynamic data structures and relevant standard algorithms for them: stack, queue, dynamically linked lists, trees, graphs, heap, priority queue, hash tables, sorting algorithms. | √ |  |  |  |  |  |  |  |  |  |  |  |
| **Demonstrate** advantages and disadvantages of specific data structures | √ |  |  |  |  |  |  |  |  |  |  |  |
| Student will be **able to choose** appropriate data structure as applied to specified problem definition. |  | √ | √ | √ |  |  |  |  |  |  |  |  |
| Student will be **able to handle** operations like searching, insertion, deletion, traversing mechanism etc. on various data structures.  . |  | √ | √ |  | √ |  |  |  |  |  |  |  |
| Student will be **able to develop** applications using data structures |  |  | √ | √ | √ |  |  |  | √ | √ |  | √ |

**Lecture Schedule**

|  |  |
| --- | --- |
| Lecture | Topic |
| 1 | Introductory concepts, Data Structures Basic: Definition, examples, operations, ADTs. |
| 2 | Array: Memory representation, Basic algorithm on array: insert, delete, search. Algorithm, complexity, best, worst, average case, Big O notation. |
| 3 | 2-D array: memory representation, matrix addition, multiplication, Sparse matrix: definition, classification, memory representation |
| 4-6 | Linked List: definition, comparison with array, Memory representation,  Basic Algorithms: insert (after & before), delete, 2-way linked list, Header, header circular. |
| 7 | Class Test 1 |
| 8 | Stack: description, push, pop, |
| 9 | Recursion: definition, factorial, Fibonacci, tower of Hanoi problem, Recursively defined data structures |
| 10-11 | Queue: description, insert, delete. Various types of queues and applications |
| 12 | Class test 2 |
| 13 | Review for midterm |
|  |  |
| 14-15 | Polish notation: value evaluation, infix to post fix. |
| 16-18 | Tree: Definition: tree, binary tree, child, parent, successor, depth, branch, tree, heap tree and heap sort, complete binary tree, Binary search tree: traversal: pre, post, in-order, Huffman Coding: example & algorithm |
| 19 | Class Test 3 |
| 20-22 | Graph: Definition: graph, complete graph, node, degree, connected graph, Search: depth-first search & breadth-first, shortest path |
| 23 | Hashing |
| 24 | Class Test 4 |
| 25 | Review |

**Required References:**

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| 1. Data Structures and Program Design, RoberL.Kruse |
| 2. Data Structures, Seymour Lipschutz, Schaum’s outlines |
|  |

**Recommended References:**

1. Data Structures Using C and C++, Yedidyah Langsam, Moshe J. Augenstein, and Aaron M. Tenenbaum, Prentice Hall.

2. Data Structures, Edward M. Reigngold.

**Grading System:** As per the approved grading scale of University of Asia Pacific (Appendix-2).

**Student’s responsibilities:** Students must come to the class prepared for the course material covered in the previous class (es).

They must submit their assignments on time.

No late or partial assignments will be acceptable. There will be no make-up quizzes.

**Appendix-1: Generic Skills**

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| **No.** | **Generic Skills** |
|  |  |
| 1. | **Engineering Knowledge** |
| 2. | **Problem Analysis** |
| 3. | **Design/Development of Solutions** |
| 4. | **Investigation** |
| 5. | **Modern Tool Usage** |
| 6. | **The Engineer and Society** |
| 7. | **Environment and Sustainability** |
| 8. | **Ethics** |
| 9. | **Communication** |
| 10. | **Individual and Team Work** |
| 11. | **Life Long Learning** |
| 12. | **Project Management and Finance** |

**Generic Skills (Detailed):**

1. **Engineering Knowledge (T)** -Apply knowledge of mathematics, sciences, engineering fundamentals and manufacturing engineering to the solution of complex engineering problems;
2. **Problem Analysis (T)** – Identify, formulate, research relevant literature and analyze complex engineering problems, and reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences;
3. **Design/Development of Solutions (A)** –Design solutions, exhibiting innovativeness, for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, economical, ethical, environmental and sustainability issues.
4. **Investigation (D)** Conduct investigation into complex problems, displaying creativeness, using research-based knowledge, and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions;
5. **Modern Tool Usage (A & D)** -Create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities, with an understanding of the limitations;
6. **The Engineer and Society (ESSE)** -Apply reasoning based on contextual knowledge to assess societal, health, safety, legal, cultural, contemporary issues, and the consequent responsibilities relevant to professional engineering practices.
7. **Environment and Sustainability (ESSE)** -Understand the impact of professional engineering solutions in societal, global, and environmental contexts and demonstrate knowledge of and need for sustainable development;
8. **Ethics (ESSE)** –Apply professional ethics with Islamic values and commit to responsibilities and norms of professional engineering code of practices.
9. **Communication (S)** -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;
10. **Individual and Team Work (S)** -Function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings.
11. **Life Long Learning (S)** -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.
12. **Project Management and Finance (S)** -Demonstrate knowledge and understanding of engineering management and financial principles and apply these to one’s own work, as a member and/or leader in a team, to manage projects in multidisciplinary settings, and identify opportunities of entrepreneurship.

**Appendix-2: Grading Policy**

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| --- | --- | --- |
| **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 |

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| **Prepared by:**  **----------------------------------** | **Checked by:**  **-----------------------------** | **Approved by: (Head of the Detp.)**  **-----------------------------** |