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|  |  | **ECTS Course Description Form** |
|  | **PART I (Senate Approval)** |
|  | **Offering School**  | **Engineering** |
|  | **Offering Department** | **Computer Engineering** |
|  | **Program(s) Offered to** | **Computer Engineering** | **Compulsory** |
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|  | **Course Code**  | **CS210** |
|  | **Course Name** | **Data Structures** |
|  | **Language of Instruction** | **English** |
|  | **Type of Course** | **Compulsory**  |
|  | **Level of Course** | **Undergraduate** |
|  | **Hours per Week** | **Lecture: 3** | **Laboratory:**  | **Recitation:**  | **Practical:**  | **Studio:** | **Other:** |
|  | **ECTS Credit** | **7** |
|  | **Grading Mode** | **Letter Grade** |
|  | **Pre-requisites** | **CS102 and CS213** |
|  | **Co-requisites** |  |
|  | **Registration Restriction** |  |
|  | **Educational Objective** | **The main objective of this course is to provide the students with a knowledge on foundations of problem solving and experience in the design and implementation of discrete data structures commonly employed in computer science and computational problems.**  |
|  | **Course Description** | **Introduction to the main concepts of data structures and algorithms. Overview of analysis tools and asymptotic notation. Discussion of recursion and its application to problem solving in computer science. Design and implementation of important abstract data types such as linked lists, doubly linked lists, stacks, queues, priority queues. Discussion of efficient sorting, searching and search tree structures.** |
|  | **Learning Outcomes**  | **LO1: Analyse and interpret main principles of recursion and its relation to mathematical induction** |  |
|  | **LO2: Employ recursion as a problem solving and programming technique and analyse efficiency of recursive solutions** |
|  | **LO3: Design and implement important abstract data types such as linked lists, doubly linked lists, stacks, and queues** |
|  | **LO4: Combinatorically analyse discrete structures such as trees, devise algorithmic solutions to search problems and gain experience in the design and implementation of common search structures such as binary search trees** |
|  | **LO5: Interpret and analyse hashing, mapping structures, priority queues, and analyse two common sorting algorithms** |
|  | **LO6: Code mini projects of 30-100 lines involving some of the covered data structures and obtain further skills in programming such as file I/O, code organization** |
|  | **PART II (Faculty Board Approval)** |
|  | **Basic Outcomes (University-wide)** | **No.** | **Program Outcomes** | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
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|  | **PO1** | **Ability** to communicate effectively and write and present a report in Turkish and English.  | 1 1 0 1 1 1 0 0 2 0 0 3 2 2 2 2 2 20 0 0 0 0 00 0 0 0 0 00 0 0 0 0 23 3 3 3 3 30 0 3 3 0 33 3 3 3 3 30 0 0 0 0 03 3 3 3 3 20 0 2 2 0 31 1 1 1 1 0 |
|  | **PO2** | **Ability** to work individually, and in intra-disciplinary and multi-disciplinary teams. |
|  | **PO3** | **Recognition** of the need for life-long learning and **ability** to access information, follow developments in science and technology, and continually reinvent oneself. |
|  | **PO4** | **Knowledge** of project management, risk management, innovation and change management, entrepreneurship, and sustainable development. |
|  | **PO5** | **Awareness** of sectors and **ability** to prepare a business plan. |
|  | **Faculty/ Program Specific Outcomes** | **PO6** | **Understanding** of professional and ethical responsibility and **demonstrating** ethical behaviour. |
|  | **PO7** | **Ability** to define complex engineeringproblems, develop models andimplement solutions for theseproblems |
|  | **PO8** | **Ability** to conduct lab experiments by usingcomputers and the ability of collecting, analysing and interpreting data.  |
|  | **PO9** | **Ability** to apply the knowledge ofmathematics, science and engineeringprinciples to solve problems in computerengineering. |
|  | **PO10** | An **understanding** of current contemporaryissues and impact of engineering solutionsin legal and ethical levels |
|  | **PO11** | **Ability** to understand and apply discretemathematics concepts. |
|  | **PO12** | **Ability** to use modern engineeringtechniques, tools and informationtechnologies and develop softwareequipment and software. |
|  | **PO13** | **Ability** to analyse, design and manage thehardware/software computer systemrequirements with limited resources andconditions by modern engineeringprinciples. |
| **PART III ( Department Board Approval)** |
| **Course Subjects, Contribution of Course Subjects to Learning Outcomes, and Methods for Assessing Learning of Course Subjects** | **Subjects** | **Week** |  | **LO1** | **LO2** | **LO3** | **LO4** | **LO5** | **LO6** |
| **S1** | 1 | An overview of Java Programming constructs  |  |  |  |  |  | A3 |
| **S2** | 2 | The relationship between induction and recursive algorithms, operations on arrays- recursive vs iterative solutions | A1/3 | A1/3 |  |  |  |  |
| **S3** | 3 | Algorithm analysis, runtime efficiency, O-notation | A1/3 | A1/3 |  |  |  |  |
| **S4** | 4 | Linear search, binary search on arrays |  | A1/3 |  |  |  |  |
| **S5** | 5 | Linked lists: Concept and design, algorithms for operations on lists (recursive and iterative) |  | A1/3 | A1/3 |  |  |  |
| **S6** | 6 | Double linked lists: Concept, design and algorithms for defined operations  |  | A1/3 | A1/3 |  |  | A3 |
| **S7** | 7 | Stacks: Concept, design, implementation alternatives (array vs linked list implementation) and algorithms for defined operations |  | A1/3 | A1/3 |  |  |  |
| **S8** | 8 | Queues: Concept, design, implementation alternatives (array vs linked list) and algorithms for defined operations |  | A1/3 | A1/3 |  |  |  |
| **S9** | 9 | An introduction to trees, their combinatorial properties, design alternatives, traversal algorithms, sample application: expression trees |  | A1/3 |  | A1/3 |  |  |
| **S10** | 10 | Binary search trees: Concept, design, Algorithms for operations on BSTs (recursive and iterative) |  | A1/3 |  | A1/3 |  | A3 |
| **S11** | 11 | The efficiency of the operations defined on BSTs, balanced binary search trees |  | A1/3 |  | A1/3 |  |  |
| **S12** | 12 | Priority queues: Concept, design, Algorithms on heaps  |  | A1/3 |  |  | A1/3 |  |
| **S13** | 13 | Maps, hashing, hash tables |  | A1/3 |  |  | A1/3 |  |
| **S14** | 14 | Sorting, Merge sort, Quick sort, comparison of sorting algorithmsOverall evaluation of the course |  | A1/3 |  |  | A1/3 | A3 |
| **Assessment Methods, Weight in Course Grade, Implementation and Make-Up Rules**  | **No.** | **Type** | **Weight** | **Implementation Rule** | **Make-Up Rule** |
| **A1** | **Exam** | *70* | *There is 1 midterm* *exam and 1 final exam for the course. The midterm’s weight is 20 and the final exam’s weight is 55. Exam dates will be shown on the tentative schedule and it can be changed according to the course schedule.*  | If a student misses an exam andprovides an acceptable legitimatedocument, a make-up exam will beprovided. |
| **A2** | **Quiz** |  |  |  |
| **A3** | **Homework** | *25* | *There are 5 homework, each with weight 5, for the course. 3 of these are coding assignments and 2 are written assignments. Each student should prepare his/her homework by himself/herself. Written homework submissions should be neatly presented. Coding assignments will be evaluated in the lab.* | There will be no make-up for the writtenhomework assignments. In case coding assignments involving laboratory demos are missed, legitimate documents should be provided for make-ups. |
| **A4** | **Project** |  |  |  |
| **A5** | **Report** |  | - | - |
| **A6** | **Presentation** |  | - | - |
| **A7** | **Attendance/ Interaction** |  | - | - |
| **A8** | **Class/Lab./****Field Work** |  | - | - |
| **A9** | **Other** |  |  |  |
| **TOTAL** | **100%** |
| **Evidence of Achievement of Learning Outcomes** | Students will demonstrate learning outcomes through midterm exam, homework assignments, the final exam. Every topic is tested with at least one exam or homework question. In order to pass, a student needs to accumulate certain percentage of points and this percentage is determined by the class mean.  |
| **Method for Determining Letter Grade** | The method on which the letter grade is based on will be announced at the beginning of the semester, andthis method may be subjected to change depending on the performance of the students. 2 midterms, 2homework assignments, and the final exam are used for grading. Letter grades are tentatively determinedusing the table below. Here “-x” means (average-3-x) and “+x” means (average+3+x), and each denotesthe minimum points necessary for the corresponding letter grade.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Total points** | +25 | +20 | +15 | +10 | +5 |  Class Average ± 3 | -5 | -10 | -15 | -20 |
| **Letter Grade** | A | A- | B+ | B | B- | C+ | C | C- | D+ | D |

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| **Teaching Methods, Student Work Load** | **No** | **Method** | **Explanation** | **Hours** |
| ***Time applied by instructor*** |
| **1** | **Lecture** | Lecturing and utilizing white board. Sample questions and answers to strengthen learning. In class exams. |  3x14=42 |
| **2** | **Interactive Lecture** |  |  |
| **3** | **Recitation** |  |  |
| **4** | **Laboratory** |  |   |
| **5** | **Practical** |  |  |
| **6** | **Field Work** |  |  |
| ***Time expected to be allocated by student*** |
| **7** | **Project** |  |  |
| **8** | **Homework** | Answers of given questions are prepared at home for written assignments. For coding assignments, the student should prepare at home before coming to lab, where a coding exercise is asked to be coded right there and the student makes a demo. | 5x7=35 |
| **9** | **Pre-class Learning of Course Material**  | New subjects are learned by watching videos or reading coursenotes before class. | 6x14=84 |
| **10** | **Review of Course Material** | Review of the subjects before exams in order to prepare. | 21 |
| **11** | **Studio** |  |  |
| **12** | **Office Hour** | One office hour per week is allocated for students’ questions | 28 |
| **TOTAL** |  *210*  |
| **IV. PART** |
| **Instructor** | **Name** | Cesim Erten |
| **E-mail** | cesim.erten@antalya.edu.tr |
| **Phone Number** | *+90-242-2450000* |
| **Office Number** | *A1-28* |
| **Office Hours** | *TBA* |
| **Course Materials** | **Mandatory** | *Data Structures and Algorithms in Java, Goodrich and Tamassia, Wiley, 6th edition, 2014.* |
| **Recommended** | *- JAVA TUTORIAL AT: JAVA.SUN.COM/DOCS/BOOKS/TUTORIAL/**- DATA STRUCTURES AND ALGORITHM ANALYSIS IN JAVA, MARK**ALLEN WEISS, ADDISON WESLEY, SECOND EDITION, 2006.* |
| **Other** | **Scholastic Honesty** | Violations of scholastic honesty include, but are not limited to cheating, plagiarizing,fabricating information or citations, facilitating acts of dishonesty by others, havingunauthorized possession of examinations, submitting work of another person or workpreviously used without informing the instructor, or tampering with the academic workof other students. Any for of scholastic dishonesty is a serious academic violation andwill result in a disciplinary action. |
| **Students with Disabilities** | Reasonable accommodations will be made for students with verifiable disabilities. |
| **Safety Issues**  |  |
| **Flexibility** | Circumstances may arise during the course that prevents the instructor from fulfillingeach and every component of this syllabus; therefore, the syllabus is subject to change.Students will be notified prior to any changes. |