School of Computing and Information Sciences

Course Title: Data Structures **Date:** 2/12/2018

Course Number: COP 3530
Number of Credits: 3

Subject Area: Programming	**Subject Area Coordinator:** Tim Downey **email:** downeyt@cs.fiu.edu
Catalog Description: Basic concepts of data organization, running time of a program, abstract types, data structures including linked lists, n-ary trees, sets and graphs, internal sorting. This course will have additional fees.	
Textbook: Data Structures & Problem Solving in Java By Mark Weiss	
References:	
Prerequisites Courses: COP 3337 and (MAD 2104 or COT 3100)	
Co-requisites Courses: None	

Type: Required

Prerequisites Topics:

- **Master the design and implementation of classes using inheritance and polymorphism**
- **Master the use and implementation of interfaces**
- **Be familiar with writing recursive methods**
- **Be familiar with the implementation of linked list data structures**
- **Be familiar with the Stack & Queue data structures**
- **Be exposed to the Java Collection interface**

Course Outcomes:

O1. Be familiar with basic techniques of algorithm analysis
O2. Master writing recursive methods
O3. Master the implementation of linked data structures such as linked lists and binary trees
O4. Be familiar with advanced data structures such as balanced search trees, hash tables, priority queues and the disjoint set union/find data structure
O5. Be familiar with several sub-quadratic sorting algorithms including quicksort, mergesort and heapsort
O6. Be familiar with some graph algorithms such as shortest path and minimum spanning tree
O7. Master the standard data structure library of a major programming language (e.g. java.util in Java 5)

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Relationship between Course Outcomes and Program Outcomes

BS in CS: Program Outcomes	Course Outcomes
a) Demonstrate proficiency in the foundation areas of Computer Science including mathematics, discrete structures, logic and the theory of algorithms	1, 2, 3, 4, 5, 6, 7
b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems.	1, 2, 3, 4, 5, 6, 7
c) Demonstrate proficiency in problem solving and application of software engineering techniques	1, 2, 3, 4, 5, 6, 7
d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other.	1, 2, 3, 4, 5, 6, 7
e) Demonstrate understanding of the social and ethical concerns of the practicing computer scientist.	
f) Demonstrate the ability to work cooperatively in teams.	
g) Demonstrate effective communication skills.	

Assessment Plan for the Course & how Data in the Course are used to assess Program Outcomes

Student and Instructor Course Outcome Surveys are administered at the conclusion of each offering, and are evaluated as described in the School's Assessment Plan: http://www.cis.fiu.edu/programs/undergrad/cs/assessment/

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Outline

Topic	Number of Lecture Hours	Outcome
• **Review of Java** o Interfaces o Function Objects o Iterators o Nested & Inner Classes	**3**	
• **Algorithm Analysis** o Basic Big-Oh o Sample $O(N^3)$,$O(N^2)$,O(N) algs o Binary Search o Divide & Conquer O(N log N) algs	**6**	**O1**
• **Sorting** o Mergesort o Quicksort o Lower Bounds o Other sorts as appropriate	**6**	**O1, O2 & O5**
• **Java Collection Data Structures** o List, ArrayList & LinkedList o Set, HashSet & TreeSet o Map, HashMap & TreeMap	**3**	**O7**
• **Stacks, Queues, Linked Lists** o Includes Java style implementation details, such as Iterator class	**4**	**O3**
• **Binary Search Trees** o including AVL trees	**4**	**O4**
• **Hash Tables**	**3**	**O4**
• **Priority Queues**	**3**	**O4**
• **Shortest Path Algorithms**	**3**	**O6**
• **Disjoint Sets**	**3**	**O4**

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Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
O2	1 assignment 2 weeks
O7	1 assignment 2 weeks
O3	1 assignment 2 weeks
O4	1 assignment 2 weeks
O6	1 assignment 2 weeks

Oral and Written Communication:
None

Social and Ethical Implications of Computing Topics:
None

Approximate number of credit hours devoted to fundamental CS topics

Topic	Core Hours	Advanced Hours
Algorithms:	1.0	
Software Design:	0	
Computer Organization and Architecture:	0	
Data Structures:	2.0	
Concepts of Programming Languages:	0	

Theoretical Contents:
None

Problem Analysis Experiences

5 assignments

Solution Design Experiences:
None

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The Coverage of Knowledge Units within Computer Science Body of Knowledge[1]

Knowledge Unit	Topic	Lecture Hours
DS 5	Graphs and Trees	**1**
AL1	Algorithm Analysis	**6**
AL2	Greedy algorithms, divide and conquer, dynamic programming, backtracking	**4**
AL3	Shortest paths, Sorting	**5**
PF 2	Algorithms and Problem Solving	**1**
PF 3	Stacks, queues, linked lists, trees, hash tables, priority queues	**14**
PF 4	Recursion	**2**
PL 6	Object-Oriented Programming	**3**
SE 2	Using APIs	**3**

[1]See http://www.computer.org/education/cc2001/final/chapter05.htm for a description of Computer Science Knowledge units