

CM-5102

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3/20/19
B8

APPROVED
GCC 2/28/19
CGSP 3/6/19



UNIVERSITY REGISTRAR
VIRGINIA TECH

Coversheet - Proposal for New and Revised Course
(Use for non-Pathways courses)

For CLE/Pathways course, form can be found here: <https://www.pathways prov.vt.edu/proposal-forms.html>

General Information			
Proposal Date:		15-Day Review End Date:	
Department:	Computer Science		
Course Designator and Number:	CS 5040		
Title of Course:	Intermediate Data Structures and Algorithm Analysis	Credit Hours:	3.0
Please refer to Office of University Registrar for guidelines and policy requirements https://www.registrar.vt.edu/faculty/teaching/instructional-minutes.html			
Course Transcript (ADP) Title: (30 Character Maximum)	Intermed Data Struct/Algorithm		
Instructor and/or Departmental Contact:	Clifford A. Shaffer		
Contact Phone:	231-4354	Contact E-mail:	shaffer@vt.edu

Please count this course toward the following Scorecard Metrics areas:

- Study Abroad
 Service Learning
 Experiential
 Undergraduate Research
 Scorecard Metrics Definitions can be found here: <http://www.registrar.vt.edu/faculty/forms/scorecard-metrics.html>

Please insert an X if this course should count toward First Year Experience:

- First Year Experience (FYE)
 For more information see: <http://www.fye.vt.edu>

Select ONE of the following boxes	
<input checked="" type="checkbox"/> New Course	<input type="checkbox"/> *Revised Course (Revision > 20% _____ Revision < 20% _____)

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*Please include a summary of course revisions to the Justification section of proposal

A:	Attach statement from Dean or Departmental Representative as to whether teaching this course will require or generate the need for additional departmental resources.		
B:	Attach appropriate letters of support from affected departments and/or colleges.		
C:	Effective Semester:	Fall 2019	
D:	Change in Title From:		
	To:		
E:	Change in Transcript Title (ADP) From:	To:	
F:	Change in Credit Hours From:	To:	
G:	Change in Lecture and/or Lab Hours From:	To:	
H:	Course Number(s) and Title(s) to be deleted from the Catalog with <u>APPROVAL</u> :		

Approval Signatures			
Department Representative		Date	1/28/2019
College Curriculum Committee Rep		Date	2/25/2019
College Dean		Date	2/25/2019

Intermediate Data Structures and Algorithm Analysis

CS 5040

I – Catalog Description

Data structures and analysis of data structure and algorithm performance. Sorting, searching, hashing, and advanced tree structures and algorithms. File system organization and access methods. Course projects develop advanced problem-solving, design, and implementation skills. Pre: Graduate standing in Computer Science and an undergraduate second semester programming course. (3H, 3C).

Course Number: 5040

Transcript (ADP) Title: Intermed Data Struct/Algorithm Anal

II – Learning Objectives

Having successfully completed this course, the student will be able to:

1. Choose the data structures that effectively model the information in a problem;
2. Judge efficiency trade-offs among alternative data structure implementations or combinations;
3. Apply algorithm analysis techniques to evaluate the performance of an algorithm and to compare data structures;
4. Implement and know when to apply standard algorithms for searching and sorting;
5. Recognize and apply design patterns, and make judgments about when a particular pattern will improve a design;
6. Design, implement, test, and debug programs using a variety of data structures including buffer pools, hash tables, binary and general tree structures, search trees, heaps, graphs, and B-trees;
7. Select appropriate methods for organizing data files and implement file-based data structures.
8. Apply design guidelines to evaluate alternative designs.

III – Justification

This course provides the critical content and proficiencies in data structures and algorithms needed for students entering the CSA Master of Engineering program with the minimum required background. It provides an in-depth analysis of data structures and illustrates how they should be used. This class prepares students for the majority of the technical CS graduate courses.

Course is taught at the 5000-level because the background and technical maturity obtained from having completed an undergraduate degree prepares them to complete the challenging technical material and programming presented.

IV – Prerequisites and Corequisites

Pre: Graduate standing in Computer Science; a traditional second programming course.

V – Texts and Special Teaching Aids

Required: None. Well-regarded collections of free, open-source online materials are widely available to teach this content. An example is <https://opensa-server.cs.vt.edu/ODSA/Books/CS3>.

VI – Syllabus

Topic	Percent of Course
Algorithm analysis and data structure performance <ul style="list-style-type: none">• Review of asymptotic notation• Analysis of performance for linear and tree data structures• Analysis of algorithm performance, including for sorting and searching	15%
Design and implementation techniques <ul style="list-style-type: none">• Unit testing• Design patterns	20%
Sorting <ul style="list-style-type: none">• $O(n^2)$ sorting algorithms• $O(n \log n)$ sorting algorithms• Bin and radix sorts• Comparing sorting algorithms, lower bounds on the sorting problem	20%
Searching and search structures <ul style="list-style-type: none">• Search trees• Heaps• Search algorithms• Hash tables• Maps and dictionaries	20%
Graphs: Representation and algorithms	10%
File access and organization <ul style="list-style-type: none">• Sequential and random access• Buffering and caching• B-trees	15%
Total	100%