School of Computing and Information Sciences

Course Title: Systems Programming **Date:** 3/18/2019

Course Number: COP 4338

Number of Credits: 3

Subject Area: Programming	**Subject Area Coordinator:** Tim Downey **email:** downeyt@cs.fiu.edu
Catalog Description: Programming in C and advanced programming in Unix environments, including multiprocessing and multithreading. This course will have additional fees.	
Textbook: *The C Programming Language* (Kernighan and Ritchie), Prentice-Hall, 1988. ISBN: 0131103628.	
References:	
Prerequisites Courses: None	
Corequisites Courses: *COP-3530 Data Structures*	

Type: **Required**

Prerequisites Topics:

- Significant programming experience in a modern programming language
- From COP3337: Master arrays and multidimensional arrays

Course Outcomes:

O1. Master C basic types, arrays, and pointers
O2. Be familiar with the UNIX development environment, using utilities such as Makefiles, gcc, and gdb
O3. Master standard Input/Output
O4. Be familiar with process address spaces: Data, Heap, Code, and Stack
O5. Master dynamic memory management
O6. Master multithreading and synchronization
O7. Master writing program solutions to problems using the above features

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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	
b) Demonstrate proficiency in various areas of Computer Science including data structures and algorithms, concepts of programming languages and computer systems.	1-7
c) Demonstrate proficiency in problem solving and application of software engineering techniques	7
d) Demonstrate mastery of at least one modern programming language and proficiency in at least one other.	1-7
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
• **C** o Basic types o Type conversions and casting o Pointers and Arrays o Standard I/O	6	O1, O2, & O3
• **UNIX** o Basic command line interface o Makefiles and gdb	2	O2
• **File I/O** o Parsing o Formatted I/O for file data	2	O3
• **Process Address Spaces** o Memory segments o Static vs dynamic segments o Segment scopes	2	O4
• **Concurrency** o Multiprocessing and IPC o Multithreading and synchronization	5	O6
• **Dynamic memory management** o Pointers o Memory allocation and deallocation	3	O5
• **Optional topics** o Sorting o Memory allocator o Socket programming o System calls o Parallel programming	5	

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Course Outcomes Emphasized in Laboratory Projects / Assignments

Outcome	Number of Weeks
O1 & O2	2
O1 & O3	2
O3 & O5	3
O4 & O5	3
O6	2

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:		0.5
Software Design:		1.5
Computer Organization and Architecture:		0.5
Data Structures:		1
Concepts of Programming Languages:		1.0

Theoretical Contents: None

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Problem Analysis Experiences

6 Programming Assignments

Solution Design Experiences

6 Programming Assignments

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

Knowledge Unit	Topic	Lecture Hours
OS 3	Concurrency (multiprocessing and multithreading)	5
OS 5	Memory management	5
OS 8	File systems and I/O	2
PF 3	Fundamental data structures	1

[1]See http://www.acm.org/education/curric_vols/cc2001.pdf Chapter 5 for a description of Computer Science Knowledge units