CS2013 recommendations

PDC topics in CS2013 -- summary

KA	KU	tier 1 lo ct	tier 2 lo ct	opt lo ct	PDC learning objectives (condensed)	compare	CSinParall	St. Olaf
							compare	compare
AR	Digital logic and digital systems	0	2	0	Comprehend that multicore is the trend in architecture. Describe implications of the "power wall."		PMC Intro GPU	HD;
AR	Assembly level machine organization	0	2	0	Describe instruction execution with threads & synchronization, SIMD. Describe ILP.			HD; OS MCA
AR	Interfacing and communication	0	1	0	Compare common network organizations.			HD;
AR	Functional organization	0	0	1	Explain ILP using pipelining and hazards that occur.			HD;
AR	Multiprocessing and alternative architect	0	0	5	Explain the concept of interconnection networks; characterize approaches and explain differences. Describe SIMD, MIMD, e.g.		(all)	HD;
AR	Performance enhancements	0	0	1	Discuss performance advantages of multithreading and difficulty achieving max benefits.		(most)	HD; PDC
CN	Processing	0	0	3	Describe task, data, and event parallelism. Compare and contrast parallel programming paradigms. Design, code, test and debug parallel programs.		(almost all)	CS1; OS PL PDC MCA
GV	Basic Rendering	0	0	1	Describe the basic graphics pipeline.			HD; ATP
HC	Collaboration and communication	0	0	1	Describe the differences between synchronous and asynch. comm.			; PDC MCA
IAS	Defensive Programming	1	0	0	Demonstrate how to prevent a race condition from occuring.			HD; OS PDC MCA
IAS	Network Security	0	2	0	Describe categories of network threats and attacks . Describe virtues and limitations of security technologies.			; OS ESD
IAS	Web Security	0	0	5	Understand the browser security model. Understand common types of vulnerabilities and attacks in web applications. ...			; OS MCA HPCC
IAS	Security Policy and Governance	0	0	1	Understand the risks and benefits of outsourcing to the cloud			; MCA
IM	Information Management Concepts	0	1	0	Describe approaches that scale up to globally networked systems.			; PDC MCA
IM	Distributed Databases	0	0	5	Explain the techniques used during distributed database design. ... Describe the three levels of software in the client-server model.		MR MR2	; MCA HPCC
IM	Information Storage and Retrieval	0	0	1	Perform Internet-based research.			many
NC	Introduction	2	0	0	Articulate organization of the Internet. Define network terminology.			HD;
NC	Networked Applications	1	0	0	Implement a simple client-server socket-based application.			; OS
NC	Reliable Data Delivery	0	2	0	Describe reliable delivery protocols and implement one.			; OS MCA
NC	Resource Allocation	0	2	0	Describe resources allocation in a network & congestion problem.			
NC	Mobility	0	1	0	Describe how wireless networks support mobile users.			
OS	Overview of Operating Systems	1	0	0	Discuss networked, client-server, distributed operating systems .			; OS MCA
OS	Operating System Principles	0	1	0	Describe the need for concurrency in an operating system			; OS
OS	Concurrency	0	4	0	Demonstrate the potential run-time problems arising from the concurrent operation of many separate tasks. Summarize the range of mechanisms that can be employed to realize concurrent systems. Describe interrupts, dispatching, and context switching.			; OS PDC
PBD	Web Platforms	0	0	2	Design and Implement a simple web application; describe software as a service.			; MCA HPCC
PD	Parallelism Fundamentals	1	0	0	Distinguish data races from higher level races.		(all)	; PDC
PD	Parallel Decomposition	1	3	0	Explain why synchronization is necessary in a specific parallel program; Write a correct and scalable parallel algorithm; Parallelize algorithms by applying task and data decomposition.		(most)	HD ADS; OS PDC
PD	Communication and Coordination	1	9	1	Give an example of an ordering of accesses among concurrent activities that is not sequentially consistent. Write correct concurrent task program. Use synchronized queue. Write a concurrent program that can reveal error, e.g. update shared variable. Describe how to avoid liveness. ...		(most)	CS1 HD SD; OS PDC MCA
PD	Parallel Algorithms, Analysis, and Prograı	0	5	3	Critical path analysis; Define speedup; Provide producer-consumer example; identify issues in P-C algorithms; give examples where pipelining applies.		(half)	; OS PDC
PD	Parallel Architecture	1	2	3	Explain the differences between shared and distributed memory; describe SMP; describe tasks that match SIMD arch.			HD; OS PDC MCA
PD	Parallel Performance	0	0	7	Amdahl's law, false sharing, scheduling, communication costs, load imbalance, ...		MR Intro GPU Hetero DD	HD; OS PDC
PD	Distributed Systems	0	0	9	Distinguish network faults from other kinds of failures; concensus algorithms; ...			; OS PDC MCA HPCC
PD	Cloud Computing	0	0	3	Discuss the importance of elasticity and resource management; deploy cloud infrastructure application; ...		MR PMC MR2 PL	CS1; PDC
PD	Formal Models and Semantics	0	0	6	Model a concurrent process using a formal model, such as pi-calculus. ...		PS PiC	ADS; TC
PL	Concurrency and Parallelism	0	0	2	Write correct concurrent programs using multiple programming models. Explain why programming languages do not guarantee sequential consistency in the presence of data races.		PMC CDS PL DD PA	PDC + courses at all curric levels
SE	Software Design	0	1	1	Given a high-level design, identify the software architecture by differentiating among common software architectures such as 3-tier, pipe-and-filter, and client-server. Use components for concurrency.		(most)	SD; PDC MCA HPCC
SE	Software Construction	0	0	1	Rewrite a simple program to remove common vulnerabilities, such as race conditions.		(most)	HD; PDC MCA
SE	Software Verification Validation	0	1	0	Describe the issues and approaches to testing distributed and parallel systems.			; PDC
SF	Computational Paradigms	3	0	0	Articulate the differences between single thread vs. multiple thread, single server vs. multiple server models. Write a simplae seq. program and a paralel version. Evaluate performance of simple sequential and parallel versions of a program with different problem sizes, and be able to describe the speed-ups achieved.		(most)	HD SD; OS PDC MCA
SF	Parallelism	6	0	0	For a given program, distinguish between its sequential and parallel execution, and the performance implications thereof. Demonstrate a timeline when execution can take place in parallel. ... Write more than one parallel program. Use performance tools to measure speedup.		(most)	HD; OS PDC MCA
SF	Evaluation	2	0	0	Describe Amdahl's law and discuss its limitations. Design and conduct a performance-oriented experiment.		PMC Intro GPU DD PA	HD; PDC MCA