dont know	know a bit	OK	good!	master	COMS 311 TOPICS		wk5	wk4	wk3	wk2	wk1
1	2	3	4	5	**BIG-OH**						
					Basics						x
					Definitions of big-oh, omega, theta c>0, n>=0 (7 things)						x
					big-omega						x
					big-theta						x
					Intuition/understanding (graph)						x
					tighter and weaker bounds					x	x
					how to prove O/Omega/Theta techniques						x
					for polynomials choose c >sum of coeff or coeff for omega						x
					for same type compare exponents						x
					take log						x
					Application to Algorithms						x
					ram model (vs actual)						x
					instances and runtime graphs					x	x
					WCET, BCET, ACET					x	x
					Big-oh of code segments					x	x
					problem complexity and algorithmic complexity						x
					code examples of different Os						x
					Big-oh in real world					x	
					real code times (matrix mult)					x	
					effect of cache/pipelining etc					x	
					choosing algo in real-world vs big-Oh					x	
					constants might matter more in real world than O					x	
					easier implementation might make the diff					x	
					Dominance Relationships						x
					logs beat constants						x
					poly beats all logs						x
					exp beats all poly						x
					fact beats all exp						x
					n^n beats fact						x
1	2	3	4	5	**DATA STRUCTURES**						
					Basic					x	x
					arrays (sorted/unsorted)					x	x
					linked lists (singly/doubly; sorted/unsorted)					x	x
					comparison of arrays and linked lists					x	x
					Basic Abstract Data Types					x	x
					Stack, Queue (implementations using array/linkedlists)					x	x
					comparison of operations of diff impl of stack/queue					x	x
					reasons for differences					x	x
					Dictionaries				x	x	
					Hash Tables				x	x	

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					Other ADTs and their Java Implementations				x	x	
					Binary Search Trees				x	x	
					Priority Search Queues				x	x	
					Heap impl				x	x	
					Fast Heap Impl and Analysis				x		
					Storing points, graphs, sets etc				x	x	
					graphs		x	x	x	x	
					sets			x	x	x	
					big-oh of operations on data structures				x	x	
					algorithms on data structures (BST, HEAP etc)				x	x	
1	2	3	4	5	**GRAPHS (unweighted)**						
					BFS			x	x		
					connected components			x	x		
					two-color problem			x	x		
					DFS on undirected graphs (tree and back edges)		x	x	x		
					articulation vertices (parent, root, bridge cutnodes)		x	x			
					DFS on directed graphs(tree,back,cross,forward)		x	x			
					topological sorting/DAG		x	x			
					strongly connected components		x	x			
					following algorithm by marking graph		x	x			
					big-oh of graph algorithms		x	x	x		
1	2	3	4	5	**Weighted GRAPHS**						
					MST		x				
					prims		x				
					kruskals		x				
					union-find data structure		x				
					reverse delete		x				
					proofs of prims and kruskals		x				
					big-ohs of prims and kruskals		x				
					Shortest Paths		x				
					Dijkstras		x				
					proof		x				
					big-oh		x				
					AllPairs Shortest		x				
					Dijkstras forall nodes		x				
					Floyd-Warshalls how algo works + big-oh		x				
					Floyd-Warshall's recurrence formula		x				
1	2	3	4	5	**P-NP**						
					Intro Concepts						x
					the diagram and four classes of problems			x			x

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					informal (solvable, probab intract, provably intract, prov unsolvable)				x			x
					examples of problems in four classes				x			x
					Halting Problem				x			x
					Hamiltonian Cycle Enumeration problem				x			x
					Hamiltonian Cycle Search problem				x			x
					Independent Set problem				x			x
					Search/Sort problems				x			x
					Classes of problems							
					Undecidable (prove Halting problem is undecidable)				x			x
					P				x			x
					NP				x			x
					prove P is a subset of NP							
					NP-Complete (probably intractable class)							x
					why if a NP-C problem is in P, then P=NP							
					provably intractable classes							x
					NP-Hard problems							
					Reduction							
					optimization, search, decision and reductions			x	x			
					definition of polynomial-time reduction & notation			x	x			
					conclusions (or implications of) from Y <=p X			x	x			
					transitive property (x <=p y, y <=p z => x<=p z)			x	x			
					how to prove X <=p Y (the three steps)			x	x			
					Yes->yes, no-> no, false positives, false negatives etc			x				
					interval sched <=p IS constructions and proofs			x	x			
					vector cover <=p IS constructions and proofs			x	x			
					IS <=p vector cover constructions and proofs			x	x			
					bipartite matching <=p IS constructions and proofs			x	x			
					given some reduction - ability to prove/disprove yes/no part			x				
					NP-Complete							
					Definition and Intuition							
					The first NP-C problem (circuitSAT) & Cook-Levin's theorem							
					how to prove that a problem is NP-C							
					prove 3-SAT is NP-C							
					prove IS is NP-C							
					prove VC is NP-C							
1	2	3	4	5	**PROOF TECHNIQUES**							
					Why is proving important?							x
					Job selection problem							x
					solutions to JS problem							x
					why is proving so important?							x
					CALCULUS							PreRe

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					propositional logic rules						PreRe
					predicate logic rules						PreRe
					form of deduction proofs						PreRe
					DIFFERENT TECHNIQUES					x	reRe
					contradiction (and correct form)		x		x	x	reRe
					induction (form)		x			x	reRe
					direct proof (see form of deduction proofs)		x			x	reRe
					trivial/vacuous					x	reRe
					contrapositive			x		x	reRe
					EXAMPLES IN CLASS						PreRe
					contradiction (and correct form)				x		PreRe
					induction (form)						PreRe
					direct proof (see form of deduction proofs)						PreRe
					trivial/vacuous						PreRe
					contrapositive			x			PreRe
					Proofs in class						
					Halting problem is undecidable				x	x	reRe
					VC <=p IS and IS <=p VC		x	x			
					select jobs satisfies greedy choice + opt substructuring						
					Proving Code correct						
					Loop invariants						
					proof of recursive codes..						
1	2	3	4	5	**ALGORITHMIC TECHNIQUES**						
					BRUTE FORCE TECHNIQUES						
					search space for different problems					x	x
					recursion tree for brute force approach					x	x
					back track algo from text book					x	x
					iterative way to generate all subsets						
					recursive way to generate all subsets					x	x
					recursive way to generate all perms					x	x
					recursive way to gen size k subsets					x	x
					DIVIDE AND CONQUER						
					recurrence formula			x	x		
					divide and conquer approach			x	x		
					mergesort + analysis			x	x		
					quicksort + analysis			x	x		
					max			x	x		
					max sum of sequence			x			
					counting inversions			x			
					finding sink in graph						

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					Recurrence Formulae				x	x		
					general form of recurrence formula & masters theorem				x	x		
					how to derive recurrence tree, term for each level, sum				x	x		
					2T(n/2) + c				x	x		
					T(n/2) + cn				x	x		
					2T(n/2) + cn				x	x		
					3T(n/2) + cn				x	x		
					2T(n/2) + cn^2				x	x		
					5T(n/2) + cn^2				x	x		
					GREEDY TECHNIQUE							
					greedy approach							
					interval scheduling by greedy approach							
					greedy choice property							
					optimal substructuring property							
					proving gc property							
					proving os property							
1	2	3	4	5	**PROGRAMMING ASSIGNMENTS**							
					2 Graduate				x			
					3 Rumors			x				
					4 Larvae Walk		x					
					6 Risk							