dont know	know a bit	OK	good!	master	COMS 311 TOPICS	ex7	ex6	ex5	ex4	ex3	ex2	ex1
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						x
					for polynomials choose c >sum of coeff or coeff for omega	x						x
					for same type compare exponents	x						x
					take log	x						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	x	
						Priority Search Queues	x				x	x	
						Heap impl	x				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	x			
					DFS on directed graphs(tree,back,cross,forward)				x	x			
						topological sorting/DAG	x		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		x				
						union-find data structure	x		x				
						reverse delete			x				
						proofs of prims and kruskals			x				
						big-ohs of prims and kruskals			x				
					Shortest Paths				x				
						Dijkstras	x	x	x				
						proof		x	x				
						big-oh		x	x				
					AllPairs Shortest				x				
						Dijkstras forall nodes		x	x				
						Floyd-Warshalls how algo works + big-oh		x	x				
						Floyd-Warshall's recurrence formula		x	x				
1	2	3	4	5	**P-NP**								
					Intro Concepts								x
						the diagram and four classes of problems				x			x
						informal (solvable, probab intract, provably intract, prov unsolvable)				x			x
						examples of problems in four classes				x			x

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							ex7	ex6	ex5	ex4	ex3	ex2	ex1
						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						x
						why if a NP-C problem is in P, then P=NP	x						
						provably intractable classes							x
						NP-Hard problems	x						
					Reduction								
						optimization, search, decision and reductions			x	x			
						definition of polynomial-time reduction & notation	x		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	x			
						how to prove X <=p Y (the three steps)	x		x	x			
						Yes->yes, no-> no, false positives, false negatives etc		x	x				
						interval sched <=p IS constructions and proofs		x	x	x			
						vector cover <=p IS constructions and proofs		x	x	x			
						IS <=p vector cover constructions and proofs		x	x	x			
						bipartite matching <=p IS constructions and proofs		x	x	x			
						given some reduction - ability to prove/disprove yes/no part		x	x				
					NP-Complete								
						Definition and Intuition	x						
						The first NP-C problem (circuitSAT) & Cook-Levin's theorem	x						
						how to prove that a problem is NP-C	x						
						prove 3-SAT is NP-C	x						
						prove IS is NP-C	x						
						prove VC is NP-C	x						
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
						propositional logic rules							PreRe
						predicate logic rules							PreRe
						form of deduction proofs							PreRe

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							ex7	ex6	ex5	ex4	ex3	ex2	ex1
					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		x					
					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							
					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		

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						ex7	ex6	ex5	ex4	ex3	ex2	ex1
					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		x					
					greedy approach		x					
					interval scheduling by greedy approach		x					
					greedy choice property		x					
					optimal substructuring property		x					
					proving gc property		x					
					proving os property		x					
1	2	3	4	5	**NETWORK FLOW**							
					Definitions							
					flow function, value of flow, max-flow	x						
					cut, capacity of cut, min-cut	x						
					proof of v(f) = sum flow out of A - sum flow in A	x						
					proof of for any flow, v(f) <= capacity of any cut	x						
					proof that there is a flow f, s.t. v(f) = capacity of min-cut	x						
					greedy algo does not work	x						
					Ford Fulkerson							
					residual graph	x						
					the algorithm	x						
					saturated and zero flow at termination of FF	x						
					ways of finding augmentation path and consequences (edmond-karp)	x						
					proof termination	x						
					proof correctness	x						
					big oh	x						
					Applications							
					reduction Bipartite Matching to flow (incl. proofs)	x						
					edge-disjoint paths to flow (also network connectivity)	x						
					Circulation with Demands	NO						
					survey	NO						
					reduction project selection to flow (incl. proofs)	NO						
1	2	3	4	5	**DYNAMIC PROGRAMMING**							
					Idea							
					tabular computing (recursive or iterative)		x					
					memoization		x					
					ex: fibonacci		x					
					Finding the solution (i.e. aside from the max/min val)		x					

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							ex7	ex6	ex5	ex4	ex3	ex2	ex1
						Properties							
						diff from Divide & Conquer, Greedy algorithms		x					
						overlapping subproblems		x					
						optimal substructuring property		x					
						examples of greedy-choice property is not satisfied		x					
						Applications (recurrence formula/table/solution)							
					1	min operations		x					
					2	rod-cutting		x					
					3	longest increasing subsequence		x					
					4	min coin change		x					
					5	subset sum		x					
					6	0-1 knapsack		x					
					7	edit-distance	x						
					8	matrix mult	x						
					9	weighted interval scheduling (select jobs)	NO						
					10	largest-sum triangle							
					11	Floyd Warshall							
					12	larvae walk							
1	2	3	4	5	**PROGRAMMING ASSIGNMENTS**								
					2	Graduate				x			
					3	Rumors			x				
					4	Larvae Walk		x					
					6	Risk	x						