CS 173, Fa Examlet 1		NF	ETI	D:								
FIRST:						AST:						
Discussion:	Thursday	2	3	4	5	Friday	9	10	11	12	1	2

(6 points) Your partner has implemented the function Merge(A,B), which merges two sorted linked lists of integers. Using Merge, fill in the missing parts of this implementation of Mergesort.

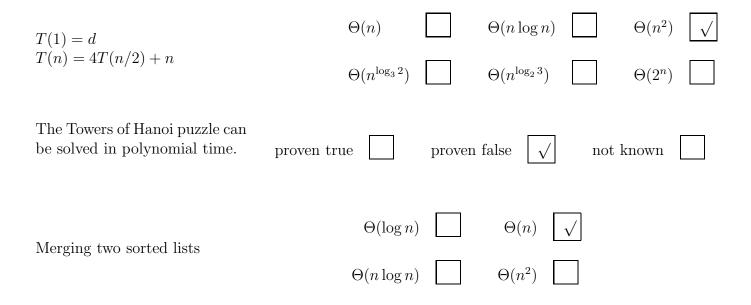
Mergesort $(L = (a_1, a_2, \dots, a_n))$ \\ input is a linked list L containing n integers

Solution: if (n=1) return L

p = floor(n/2)

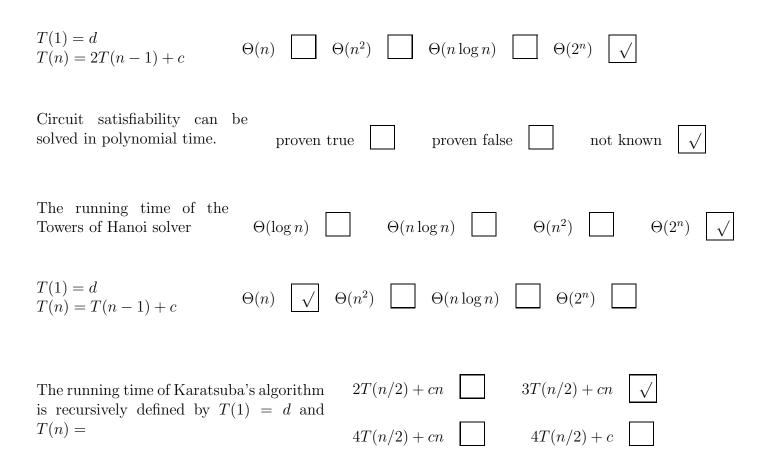
Solution: $L_a = (a_1, \dots, a_p)$ $L_b = (a_{p+1}, \dots, a_n)$ return Merge(Mergesort(L_a), Mergesort(L_b))

(9 points) Check the (single) box that best characterizes each item.



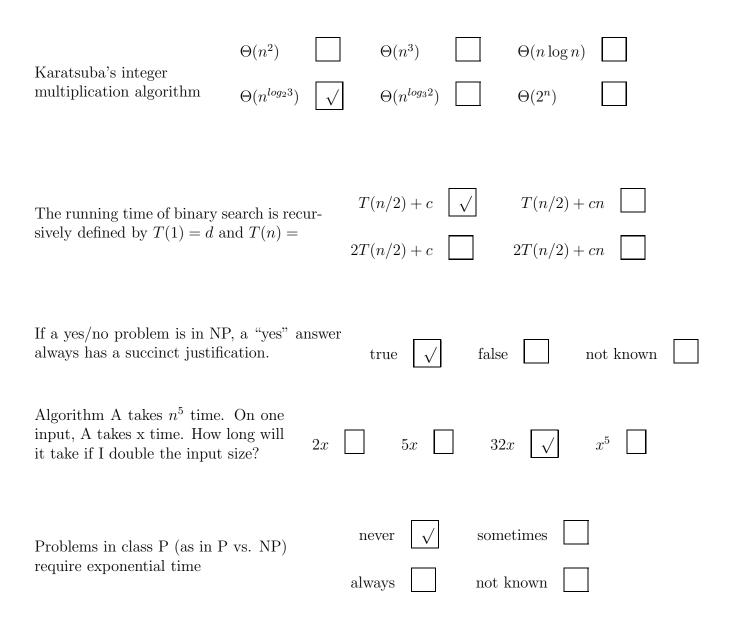
CS 173, Fa Examlet 1		NI	ETI	D:								
FIRST:					L	AST:						
Discussion:	Thursday	2	3	4	5	Friday	9	10	11	12	1	2

(15 points) Check the (single) box that best characterizes each item.



CS 173, Fa Examlet 1		NI	ETI	D:								
FIRST:					L	AST:						
Discussion:	Thursday	2	3	4	5	Friday	9	10	11	12	1	2

(15 points) Check the (single) box that best characterizes each item.



CS 173, Fa Examlet 1		NI	ETI	D:								
FIRST:						AST:						
Discussion:	Thursday	2	3	4	5	Friday	9	10	11	12	1	2

(15 points) Check the (single) box that best characterizes each item.

The running time of the Towers of Hanoi solver is recursively defined by $T(1) = d$ and $T(n) =$	$2T(n-1) + c \qquad \checkmark \qquad 2T(n-1) + cn \qquad \square$ $2T(n/2) + c \qquad \square \qquad 2T(n/2) + cn \qquad \square$
If a yes/no problem is in co-NP, a "no" answer always has a succinct justification.	true \checkmark false not known
The running time of the Towers of Hanoi solver $\Theta(\log n)$	$\Theta(n\log n)$ $\Theta(n^2)$ $\Theta(2^n)$ $$
Algorithm A takes 2^n time. On one input, A takes x time. How long will it take if I double the input size? $2x$	2^x x^2 $$
Finding the chromatic number of a graph with n nodes requires $\Theta(2^n)$ time.	proven true proven false not known \checkmark

CS 173, Fa Examlet 1		NI	ETI	D:]			
FIRST:					L	AST:						
Discussion:	Thursday	2	3	4	5	Friday	9	10	11	12	1	2

(6 points) Fill in the missing bits of this recursive algorithm for returning the location of a number k in a sorted list of numbers $a_p, a_2, ..., a_q$.

search(p,q,k) $\backslash \backslash$ assume $p \leq q$ $m := \lfloor (p+q)/2 \rfloor$ if $k = a_m$ then return m else if $(k < a_m)$ and p < m then Solution: search(p,m-1,k) else if $(k > a_m)$ and q > m then Solution: search(m+1,q,k)

else return -1 $\$ i.e. error, not found

(9 points) Check the (single) box that best characterizes each item.

a propositional l true by picking t	ial time to determinogic expression car the right true/false variables (e.g. p, q,	n be made values for	proven true not known		proven false	
The running time	of mergesort is $O(n)$	n ³). True	\checkmark	False		
$n^{\log_2 3}$ grows	faster than n^2	slower t	han n^2 v	/ at	the same rate as	n^2

CS 173, Fa Examlet 1		NF	ETI	D:]			
FIRST:						AST:						
Discussion:	Thursday	2	3	4	5	Friday	9	10	11	12	1	2

(6 points) Fill in the missing bits of the recursive algorithm for solving the Towers of Hanoi puzzle.

hanoi $(A, B, C: \text{ pegs}, d_1, d_2 \dots d_n: \text{ disks}) \setminus \text{ move n disks from peg A to peg B}$

if (n = 1) move d_1 from A to B

else

Solution: hanoi(A, C, B: pegs, $d_1, d_2 \dots d_{n-1}$: disks) \setminus move smaller disks to C

move d_n from A to B

Solution: hanoi(C,B,A: pegs, $d_1, d_2 \dots d_{n-1}:$ disks $) \setminus$ move smaller disks to B

(9 points) Check the (single) box that best characterizes each item.

Determining whether a graph with n edges is connected.	polynomi	al $$	exponential	i	n NP
The running time of mergesort sively defined by $T(1) = d$ and T		2T(n-1) = 2T(n/2)		2T(n-1) $2T(n/2)$	
The running time of binary search $\Theta(\log n)$)	$\Theta(n)$	$\Theta(n \log n)$)	$\Theta(n^2)$