CS 173 (B), Spring 2015, Examlet 7, Part B

NAME:	NETID:

Discussion Section: BDA:1PM BDB:2PM BDC:3PM BDD:4PM BDE:5PM

1. Choose all the correct statements. [6 points]

☑ A. A state-diagram can have zero or more final states, but exactly one start state.

☐ B. There can be no transitions out of a final state in a state-diagram.

☐ C. If a state-diagram is deterministic, and it has two states `A` and `B`, then there cannot be two different edges between them, both directed from `A` to `B`.

☐ D. None of the above.

2. The problem of graph 3-colorability, 3COL, is **NP**-Complete. Which of the following statements are known to be implied by this? [6 points]

☐ A. If some problem in **NP** is in **P**, then 3COL $\in$ **P**.

☑ B. If 3COL $\in$ **P**, then every problem in **NP** is in **P**.

☑ C. If every problem in **NP** is in **P**, then 3COL $\in$ **P**.

☐ D. None of the above.

3. Consider a recursive sorting algorithm RSort that takes (A, n) where A is an array of size at least n, and sorts the first n positions of A. (So to sort an entire array using RSort, we can set n to be the size of the array.)

   On input (A, n), RSort works as follows. If $n = 1$, RSort returns A without modifying it. Otherwise, first it calls a function FindMax(A), which scans the array once, finds the index of the maximum element, and returns it. Let this index be $i_{\max}$. Then RSort swaps $A[i_{\max}]$ and $A[n]$ in constant time. Finally it calls RSort$(A, n-1)$, and returns A as returned from the recursive call, without further modification.

   Which recurrence relation is applicable to the running time of RSort (for $n > 1$). [8 points]

☐ A. $T(n) = 2T(n-1) + \Theta(n)$

☐ B. $T(n) = 2T(n-1) + \Theta(1)$

☑ C. $T(n) = T(n-1) + \Theta(n)$

☐ D. $T(n) = T(n-1) + \Theta(1)$

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