CS 270 (Fall 2020) Practice/Example Quiz

There are 2 pages and 9 questions.

This quiz is closed book, closed notes. **By submitting the quiz, you assert that you solved the quiz by yourself, without consulting any books, notes, online sources, or other help.** For multiple choice questions, any number of answers (including possiby none or all) may be correct. Mark all that apply.

GOOD LUCK

(1) When we say that Bubble Sort has worst-case running time $\Omega(n^2)$, what do we mean?

- [ ] There is a constant c such that for all arrays of length n, Bubble Sort takes at least cn^2 steps.
- [ ] There is a constant c such that for all n, there is an array of length n on which Bubble Sort takes at least cn^2 steps.
- [ ] There is a constant c and an n such that for some array of length n, Bubble Sort takes at least cn^2 steps.

(2) Which of these sorting algorithms have a worst-case running time of $O(n \log n)$?

- [ ] Bubble Sort
- [ ] Heap Sort
- [ ] Insertion Sort
- [ ] Merge Sort
- [ ] Quick Sort (with good median finding)
- [ ] Selection Sort

(3) Which of these functions are $O(n^2)$?

- [ ] 3
- [ ] $(2n)^2$
- [ ] $(\log n)^4$
- [ ] 2^n
- [ ] $\frac{1}{100}n^3$
- [ ] $\log \log n$
- [ ] $(\log n)^{\log n}$
- [ ] $4n \log n$
- [ ] $n^2 + 4n \log n$

(4) Among the following subsets of (undirected) graphs, determine which are subsets of each other. In the table below, check each cell (A, B) such that the following statement holds: "every A is also a B".

$A \downarrow \quad \mid \quad B \rightarrow$	cycle	tree	forest	connected graph	acyclic graph	bipartite graph	path
cycle							
tree							
forest							
connected graph							
acyclic graph							
bipartite graph							
path							

(5) For random variables X, Y, denoting expectations by $\mathbb{E}[X], \mathbb{E}[Y]$, which of the following are true?

- [ ] $\mathbb{E}[X+Y] = \mathbb{E}[X] + \mathbb{E}[Y]$ always.
- [ ] $\mathbb{E}[X+Y] = \mathbb{E}[X] + \mathbb{E}[Y]$ when X and Y are independent (but not always).
- [ ] $\mathbb{E}[XY] = \mathbb{E}[X] \cdot \mathbb{E}[Y]$ always.
- [ ] $\mathbb{E}[XY] = \mathbb{E}[X] \cdot \mathbb{E}[Y]$ when X and Y are independent (but not always).

(6) Suppose that you found the solutions for a homework problem online or in another textbook, and basically copied them, while changing some words. 10 minutes before the homework deadline, you feel bad about what you did, and write on top of your submission that you copied the solution, and where you copied the solution from. What are the likely outcomes?

[ ] Because you copied solutions from somewhere else, you will be accused of cheating, talk to SJACS, and likely get an F in the class.

[ ] The instructors will not consider this cheating, because you didn't try to pass the work off as your own.

[ ] You will get a 0 on the question, as your submission does not show your own work.

[ ] You will get only partial credit, because you had significant help.

[ ] You will get full credit, because you were honest and also showed that you understood the solution.

(7) If you have n items, how many different pairs of items can you form from them?

[ ] $n!$

[ ] 2^n

[ ] $\frac{n(n-1)}{2}$

[ ] n

(8) Consider an *undirected* graph G, and the relation $R(u, v)$ that is defined as "there is a path from u to v". Which of the following statements are true for R?

[ ] R is reflexive.

[ ] R is transitive.

[ ] R is symmetric.

[ ] R is asymmetric.

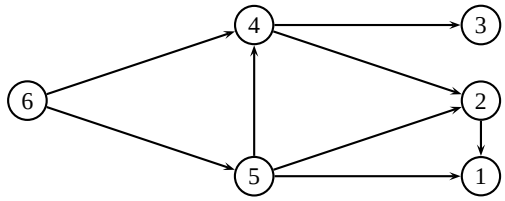
[ ] R is antisymmetric.

[ ] R is an equivalence relation.

[ ] R is a partial order.

[ ] R is a total order.

(9) If you perform a breadth-first search (BFS) on the given graph, starting from node 6, which of the edges of the graph will be part of the BFS tree? Assume that ties are broken in favor of lower-numbered nodes.



[ ] $(6, 4)$

[ ] $(6, 5)$

[ ] $(4, 3)$

[ ] $(4, 2)$

[ ] $(5, 4)$

[ ] $(5, 2)$

[ ] $(5, 1)$

[ ] $(2, 1)$