Assignment 3

The due date for submitting this assignment has passed.

Due on 2021-02-10, 23:59 IST.

As per our records you have not submitted this assignment.

1) Let T be a rooted binary tree of n nodes and height h that represents an arithmetic expression as follows: each leaf node of T is labeled with an integer in the range 1 to n and each non-leaf node is labeled with "+" or "-". Given T as an input, what is best space bound that can be achieved for evaluating the expression represented by T? **3 points**

- $O(n)$
- $O(h)$
- $O(\log n)$
- $O(n+h)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$O(h)$

2) Given an $n \times n$ matrix A such that each entry of A is either 0 or 1. What is the best space complexity known to compute A^n? **3 points**

- $O(n)$
- $O(\log n)$
- $O(n \log n)$
- $O(\log^2 n)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$O(\log^2 n)$

3) Consider the following language: **3 points**
$NEGCYCLE = \{G \mid G$ is weighted directed graph that contains a cycle of negative weight$\}$.
What is the smallest complexity class known that $NEGCYCLE$ belongs to?

- $NEGCYCLE \in L$
- $NEGCYCLE \in NL$
- $NEGCYCLE \in P$
- $NEGCYCLE \in NP$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$NEGCYCLE \in NL$

4) Consider the following language: **3 points**
$LTQBF = \{\phi \mid \phi$ is a TQBF such that at most $\log n$ many variables in ϕ have quantifiers$\}$.
What is the smallest complexity class known that $LTQBF$ belongs to?

- $LTQBF \in NL$
- $LTQBF \in P$
- $LTQBF \in NP$
- $LTQBF \in PSPACE$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$LTQBF \in NP$

5) Given an undirected graph G what is the best space bound that can be achieved for computing a spanning tree of G? **3 points**

- $O(n)$
- $O(n^2)$
- $O(\log^2 n)$
- $O(\log n)$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$O(\log n)$

6) Suppose we have $\Pi_2^p \neq \Sigma_2^p$. What can we conclude for P, NP and $coNP$? **2 points**

- $P = NP$
- $P \neq NP$
- $P \subsetneq NP$, where ($\subsetneq$ represents strict subset)
- $P = NP \cap coNP$

No, the answer is incorrect.
Score: 0
Accepted Answers:
$P \neq NP$
$P \subsetneq NP$, where ($\subsetneq$ represents strict subset)

7) Consider the following statements **2 points**
1. L = NL
2. NL = P
3. P = NP
4. NP = PSPACE
Mark all the correct options below.

- All the above statements can be true.
- All of the above statements can be false.
- Some of them can be true.
- If directed reachability can be solved in L then 1 is true.

No, the answer is incorrect.
Score: 0
Accepted Answers:
All of the above statements can be false.
Some of them can be true.
If directed reachability can be solved in L then 1 is true.

8) Which of the following is(are) true for logspace reduction ($\leq_l$)? **1 point**

- $\leq_l$ is reflexive
- $\leq_l$ is symmetric
- $\leq_l$ is transitive
- $\leq_l$ is one-to-one

No, the answer is incorrect.
Score: 0
Accepted Answers:
$\leq_l$ is reflexive
$\leq_l$ is transitive

9) A graphs G is called a layered DAG (directed acyclic graph) if vertices of G can be partitioned into layers $l_1, l_2, \ldots l_k$ such that each edge in G always goes from layer l_i to l_{i+1}, for all $1 \leq i \leq k-1$. Consider the following language. **2 points**
$REACHLDAG = \{\langle G, s, t\rangle \mid G$ is a layered DAG and there is a directed path from s to t in $G\}$.
Which of the following statement is (are) known to be true?

- $REACHLDAG \in L$
- $REACHLDAG \in NL$ but $REACHLDAG \notin L$
- $REACHLDAG \in NL$
- $REACHLDAG$ is NL-hard

No, the answer is incorrect.
Score: 0
Accepted Answers:
$REACHLDAG \in NL$
$REACHLDAG$ is NL-hard