Assignment 2

The due date for submitting this assignment has passed.

Due on 2021-02-07, 23:59 IST.

As per our records you have not submitted this assignment.

1) Mark all the correct options — *6 points*

- $NP = SPACE(n) \implies SPACE(n) = SPACE(n^2)$
- $SPACE(n) \neq SPACE(n^2) \implies P \neq SPACE(n)$
- For time constructible functions t_1, t_2, g, $TIME(t_1(n)) \subsetneq TIME(t_2(n)) \implies TIME(t_1(g(n))) \subsetneq TIME(t_2(g(n)))$
- For space constructible functions s_1, s_2, f, $NSPACE(s_1(n)) \subseteq SPACE(s_2(n)) \implies NSPACE(s_1(f(n))) \subseteq SPACE(s_2(f(n)))$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$NP = SPACE(n) \implies SPACE(n) = SPACE(n^2)$
$SPACE(n) \neq SPACE(n^2) \implies P \neq SPACE(n)$
For space constructible functions s_1, s_2, f,
$NSPACE(s_1(n)) \subseteq SPACE(s_2(n)) \implies NSPACE(s_1(f(n))) \subseteq SPACE(s_2(f(n)))$

2) Which of the following statements is/are true? — *6 points*

- If f is time constructible, then $TIME(f(n)) \subsetneq NTIME(f(n))$
- There exists a function f such that $TIME(f(n)) = TIME(2^{f(n)})$
- If f is a time constructible function, then $TIME\left(o\left(\frac{f(n)}{\log f(n)}\right)\right) \subsetneq TIME(f(n))$
- The class P could in principle collapse to $TIME(n^k)$ for some fixed k

No, the answer is incorrect.
Score: 0

Accepted Answers:
There exists a function f such that $TIME(f(n)) = TIME(2^{f(n)})$
If f is a time constructible function, then
$TIME\left(o\left(\frac{f(n)}{\log f(n)}\right)\right) \subsetneq TIME(f(n))$

3) Mark all the true statements — *4 points*

- $P \subsetneq P^P$
- For any oracle A, $P^A \subsetneq EXP^A$
- Let $TIME^A(f(n)) = \{L \mid$ there is an oracle machine M^A that decides L and runs in time $f(n)\}$ There exists an oracle A such that $TIME^A(n^2) = TIME^A(n^3)$
- There exists an oracle A relative to which P and NP are different

No, the answer is incorrect.
Score: 0

Accepted Answers:
For any oracle A, $P^A \subsetneq EXP^A$
There exists an oracle A relative to which P and NP are different

4) Which of the following statements is/are true? — *2 points*

- $TIME(f(n)) \subseteq SPACE(f(n))$
- $NSPACE(n^2 + 3) \subseteq SPACE(n^4 + 6n^2 + 9)$
- $NSPACE(f(n)) \subseteq SPACE(f(n))$
- $NPSPACE \subseteq EXP$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$TIME(f(n)) \subseteq SPACE(f(n))$
$NSPACE(n^2 + 3) \subseteq SPACE(n^4 + 6n^2 + 9)$
$NPSPACE \subseteq EXP$

5) Mark all the statements that are known to be true — *2 points*

- $NL = P$
- $EXPSPACE = NEXPSPACE$
- Directed graph reachability problem can be solved in $O(\log(n))$ space
- Directed graph reachability problem can be solved in $O(\log^2(n))$ space

No, the answer is incorrect.
Score: 0

Accepted Answers:
$EXPSPACE = NEXPSPACE$
Directed graph reachability problem can be solved in $O(\log^2(n))$ space

6) Mark all the true statements about the polynomial time reduction relation $\leq_p$ — *2 points*

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

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\leq_p$ is reflexive
$\leq_p$ is transitive

7) Given a DFA D and an input x, we need to decide if D accepts x. What is the smallest class in which we can do this? — *2 points*

- L
- NL
- P
- NP

No, the answer is incorrect.
Score: 0

Accepted Answers:
L

8) The class NL is closed under which of the following operations? Mark all that apply — *2 points*

- Intersection
- Union
- Concatenation
- Kleene Closure

No, the answer is incorrect.
Score: 0

Accepted Answers:
Intersection
Union
Concatenation
Kleene Closure

9) For any positive integer n, let n' be the integer whose binary representation is the reverse of the binary representation of n (assume that binary representation of n has no leading zeros). Let $f(n) = n + n'$ for all n. Consider the following statements:
$L_1 = \{\langle m, n\rangle \mid f(m) = n\}$
$L_2 = \{\langle m, n\rangle \mid f(f(m)) = n\}$ — *4 points*

- Only L_1 is in L
- Only L_2 is in L
- Both L_1 and L_2 are in L
- Both L_1 and L_2 are not in L

No, the answer is incorrect.
Score: 0

Accepted Answers:
Both L_1 and L_2 are in L