

# CSPB 3104 - Park - Algorithms

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**Marks** 13.00/13.00

**Grade** 10.00 out of 10.00 (100%)

Question 1

Correct

Mark 1.00 out of 1.00

Consider the following optimization problem –

Maximize  $(2x + 3y)$

$x + y \geq 1$

$y \geq 3$

$x \geq 0$

Which option below best describes the linear programming solution?

Select one:

- ☐ a. Bounded
- ☐ b. Unbounded
- ☐ c. Feasible and bounded
- ☒ d. Feasible but unbounded
- ☐ e. Infeasible

Your answer is correct.

The correct answer is: Feasible but unbounded

Correct

Marks for this submission: 1.00/1.00.

## Question 2

Correct

Mark 1.00 out of 1.00

Which of the following is the **TRUE** statement about P and NP classes?

Select one:

- ☐ a.  $P = NP$
- ☐ b. NP can be solved in polynomial time
- ☐ c. NP cannot be solved in polynomial time
- ☒ d. P is a subset of NP

Your answer is correct.

The correct answer is: P is a subset of NP

Correct

Marks for this submission: 1.00/1.00.

## Question 3

Correct

Mark 1.00 out of 1.00

Which of the following is **NOT** a known example of an NP complete problem?

Select one:

- ☐ a. Existence of a Hamiltonian Cycle in a directed graph
- ☐ b. 3-CNF Satisfiability
- ☒ c. Finding a shortest simple path in a graph
- ☐ d. Finding a longest simple path in a graph

Your answer is correct.

The correct answer is: Finding a shortest simple path in a graph

Correct

Marks for this submission: 1.00/1.00.

## Question 4

Correct

Mark 3.00 out of 3.00

Select all the facts that follow if we were to prove  $P = NP$ .

Select one or more:

- ☒ a. 3-CNF-SAT can be solved in polynomial time.
- ☒ b. There will be a polynomial time algorithm for solving the travelling salesperson problem.
- ☒ c. The problem of finding if a graph  $G$  has a cycle will be NP Complete.
- ☒ d. Every NP Complete problem will have a polynomial time algorithm.
- ☒ e. Internet commerce using RSA public key encryption may become insecure.

Your answer is correct.

The correct answers are: There will be a polynomial time algorithm for solving the travelling salesperson problem., The problem of finding if a graph  $G$  has a cycle will be NP Complete., Internet commerce using RSA public key encryption may become insecure., Every NP Complete problem will have a polynomial time algorithm., 3-CNF-SAT can be solved in polynomial time.

Correct

Marks for this submission: 3.00/3.00.

## Question 5

Correct

Mark 3.00 out of 3.00

If  $P$  were shown different from  $NP$ , select all the valid consequences below.

Select one or more:

- ☒ a. All NP Complete problems cannot be solved in polynomial time.
- ☐ b. There will be problems in  $P$  that are NP Complete.
- ☒ c. There will be problems in  $NP$  that are not NP Complete.
- ☐ d. Some of the NP Complete problems may have polynomial time algorithms while at least one of them will not.

Your answer is correct.

The correct answers are: All NP Complete problems cannot be solved in polynomial time., There will be problems in  $NP$  that are not NP Complete.

Correct

Marks for this submission: 3.00/3.00.

## Question 6

Correct

Mark 2.00 out of 2.00

Suppose A can be solved in polynomial time and B is known to be NP and we have a polynomial time reduction from B to A. What can we conclude from these facts?

Select one:

- ☐ a. A is NP Complete
- ☐ b. B cannot be solved in polynomial time.
- ☐ c. P is different from NP
- ☐ d.  $P = NP$
- ☐ e. B is NP complete
- ☒ f. B can be solved in polynomial time.

Your answer is correct.

The correct answer is: B can be solved in polynomial time.

Correct

Marks for this submission: 2.00/2.00.

## Question 7

Correct

Mark 2.00 out of 2.00

The lecture emphasized that to prove a problem X NP complete, we need to find a **polynomial time** reduction from a known complete problem (eg., 3-SAT) to X.

Prof. Z claims that the requirement for polynomial time reduction is not needed at all. If this were true, which of the following facts will hold.

Select one:

- ☐ a. P can be proved to be not equal to NP.
- ☒ b. Every problem in NP can be reduced in exponential time to every other problem in NP
- ☐ c. Nothing changes, the requirement for polynomial time reductions is unnecessary.
- ☐ d. The 3-SAT problem can be solved in polynomial time.

Your answer is correct.

The correct answer is: Every problem in NP can be reduced in exponential time to every other problem in NP

Correct

Marks for this submission: 2.00/2.00.

