Started on	Monday, 10 January 2022, 9:18 AM
State	Finished
Completed on	Monday, 10 January 2022, 9:35 AM
Time taken	16 mins 52 secs
Marks	4.50/5.00
Grade	**9.00** out of 10.00 (**90**%)

Question **1**

Partially correct

Mark 0.50 out of 1.00

Given the following tableau of a PLC problem in minimization form:

x_1	x_2	x_3	x_4	x_5	
0	2	0	α	-3	-5
1	0	0	δ	-2	β
0	1	1	-1	2	8

Select one or more:

- [x] a. if $\alpha = \delta = 0$, the columns of x_1 and x_4 give a dual feasible solution ✖
- [ ] b. if $\alpha = 0$, $\beta > 0$, the columns of x_1 and x_2 give a primal feasible solution
- [ ] c. if $\alpha > 0$, the tableau represents an optimal solution
- [x] d. if $\beta \geq 0$ the problem is non empty ✔
- [ ] e. the problem is unlimited, independently of the values of α, β and δ

The correct answers are: if $\beta \geq 0$ the problem is non empty
, if $\alpha = 0$, $\beta > 0$, the columns of x_1 and x_2 give a primal feasible solution

Question **2**

Correct

Mark 1.00 out of 1.00

The reduced cost of a basic variable x_j, in a tableau in basic form:

Select one or more:

- [x] a. represents the variation of the objective function when the basis changes ✗
- [ ] b. is always null
- [ ] c. is strictly positive if the current solution is optimal and the problem is in minimization form
- [x] d. has a non-negative value if the current solution is optimal and the problem is in minimization form ✓
- [ ] e. has a non-positive value if the current solution is optimal and the problem is in minimization form

The correct answer is: has a non-negative value if the current solution is optimal and the problem is in minimization form

Question **3**

Correct

Mark 1.00 out of 1.00

The deep first exploration strategy for branch-and-bound:

Select one or more:

- [x] a. starting from a father problem explores the first son problem generated ✓
- [ ] b. explores first the problem with smallest lower bound
- [ ] c. starting from a father problem explores all the sons problem generated before considering problems at a lower level
- [ ] d. explores first the problem with highest lower bound
- [x] e. after a backtracking step, explores the first unexplored son problem, if any. ✓

The correct answers are: starting from a father problem explores the first son problem generated, after a backtracking step, explores the first unexplored son problem, if any.

Question **4**

Correct

Mark 1.00 out of 1.00

An NP-complete problem described by a Linear Integer Programming model,

Select one or more:

- [x] a. can be solved with a sequence of shortest path computations ✖
- [x] b. can be solved with a branch-and-bound method ✔
- [ ] c. can be solved with the dual simplex method
- [ ] d. can be solved with the revised simplex method
- [ ] e. cannot be solved with an exact algorithm

The correct answer is: can be solved with a branch-and-bound method

Question **5**

Correct

Mark 1.00 out of 1.00

Consider a graph $G = (V, E)$ with edge costs c_{ij}, a starting vertex $s \in V$ and an iteration of the Prim-Dijkstra algorithm to find the Shortest Spanning Tree Problem, and let $S \subset V$ be the set of vertices with permanent labels (i.e., the vertices already included in the tree). In such configuration:

Select one or more:

- [ ] a. all the optimal path from s to $j \in V \setminus S$ cannot use vertices of S
- [ ] b. the problem has no solution if the labels of vertices in $V \setminus S$ are negative
- [x] c. the next vertex to be added to the tree is the vertex $v \in V \setminus S$ with minimum label ✔
- [x] d. each vertex $v \in S$ is reached from s by a shortest path using only vertices in S ✔
- [ ] e. the next vertex to be added to the tree is $v \in V \setminus S$ such that $c_{iv} = \min_{i \in S, j \in V \setminus S} c_{ij}$

The correct answers are: each vertex $v \in S$ is reached from s by a shortest path using only vertices in S, the next vertex to be added to the tree is the vertex $v \in V \setminus S$ with minimum label

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