Operations Research III: Theory

Quiz for Week 8 (Course Summary and Future Directions)

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1. For the following statements, select all that are correct:

   (a) The dual program of a linear program is unique.

   (b) The dual program of the dual program of a linear program is the original one.

   (c) If a primal constraint is binding, the corresponding dual variable is positive.

   (d) A solution $\bar{x}$ is optimal to a linear program P if and only if there exists another solution $\bar{y}$ that is optimal to the dual program of P and the objective values associated with $\bar{x}$ and $\bar{y}$ are identical.

   (e) None of the above.

2. For the following statements, select all that are correct:

   (a) For a linear program, the shadow price of a constraint is unique.

   (b) Suppose that for a linear program the objective value of an optimal solution is z^*. Moreover, the shadow price of a constraint is 3. In this case, if the right-hand side of that constraint is increased by 1, the objective of an optimal solution to the new program will be $z^* + 3$.

   (c) For a linear program with a maximization objective function, the shadow price of a greater-than-or-equal-to constraint is nonpositive.

   (d) Suppose that a linear program has been solved, and an optimal basis B^* is obtained. When a new variable is added, B^* still remains optimal.

   (e) None of the above.

3. For the following statements, select all that are correct:

   (a) A maximum flow problem can be formulated as an assignment problem.

   (b) An assignment problem can be formulated as a maximum flow problem.

   (c) An assignment problem can be formulated as a shortest path problem.

   (d) A shortest path problem can be formulated as a maximum flow problem.

   (e) None of the above.

4. For the following nonlinear programs, select all that are convex programs:

   (a) An unconstrained nonlinear program in which a convex function is minimized.

   (b) An unconstrained nonlinear program in which a convex function is maximized.

   (c) An unconstrained nonlinear program in which a concave function is minimized.

   (d) An unconstrained nonlinear program in which a concave function is maximized.

   (e) None of the above.

5. For the following statements, select all that are correct:

   (a) A set is a concave set if it is not a convex set.

   (b) The KKT condition is necessary and sufficient for all nonlinear programs.

   (c) For the objective value of an optimal solution to a nonlinear program with a maximization objective function, Lagrange relaxation always gives us an upper bound.

   (d) Linear programming duality is a special case of Lagrange duality.

   (e) None of the above.