Quiz 2

Question 1: Simplex-algorithm

$$\begin{aligned} \max . \, & z = x_1 + x_2 \\ \text{s.t. } & 2x_1 + x_2 \leq 4 \\ & 2x_1 + 5x_2 \leq 10 \\ & x_1, x_2 \geq 0 \end{aligned}$$

Solve the above linear optimization problem using the Simplex algorithm. Which of the following options corresponds to the final x_1-row?

a) $x_1 + \frac{3}{8}s_1 + \frac{1}{8}s_2 = \frac{11}{4}$

b) $-x_1 - \frac{5}{8}s_1 + \frac{1}{8}s_2 = \frac{5}{4}$

c) $x_2 - \frac{1}{4}s_1 + \frac{1}{4}s_2 = \frac{3}{2}$

d) $x_1 + \frac{5}{8}s_1 - \frac{1}{8}s_2 = \frac{5}{4}$

Question 2: Simplex Special Cases

$$\begin{aligned} \min . \, & x_1 + 2x_2 \\ \text{s.t. } & 3x_1 - 2x_2 \leq 3 \\ & 2x_1 + x_2 \geq 4 \\ & x_1, x_2 \geq 0 \end{aligned}$$

1) Form the standard form of the above linear optimization problem. How many slack variables do you need, and what are their coefficients in the constraints in which they appear?

   a) There are no slack variables in the standard form.

   b) One slack variable with coefficient -1.

   c) Two slack variables, one with coefficient 1 and one with -1.

   d) Two slack variables, each with coefficient 1.

2) Formulate the big M-formulation from the standard form and develop the z-row by substituting out the artificial variables. Which of the following tables depicts the correct z-row?

a) Table A:

	x_1	x_2	s_1	s_2	R_1	Sol
z	-1	1	0	1	0	-4

b) Table B:

	x_1	x_2	s_1	s_2	R_1	Sol
z	$1-2M$	$2-M$	0	M	0	$-4M$

c) Table C:

	x_1	x_2	s_1	s_2	R_1	Sol
z	1	2	0	0	M	0

d) Table D:

	x_1	x_2	s_1	s_2	R_1	Sol
z	$2M-1$	$M-2$	0	M	0	$-4M$

3) Formulate the first Phase of the 2-phase formulation of the standard form. How many variables does it have, besides x_1 and x_2? What is the objective function?

a) 2 extra variables, objective: $\min z_1 + z_2$

b) 3 extra variables, objective: $\min -z_1 - z_2$

c) 3 extra variables, objective: $\max -z_1 - z_2$

d) 4 extra variables, objective: $\max -z_1 - z_2$