Name: _____

MATH 108
Fall 2023
HW 16: Due 12/12

"Linear programming can be viewed as part of a great revolutionary development which has given mankind the ability to state general goals and to lay out a path of detailed decisions to take in order to 'best' achieve its goals when faced with practical situations of great complexity."

– George Dantzig

Problem 1. (10pt) Find the initial simplex tableau corresponding to the linear programming problem shown below:

$$\max z = 4x_1 - x_2 + 5x_3$$

$$\begin{cases} x_1 + 7x_3 \leq 20 \\ x_1 - 5x_2 + 9x_3 \geq -20 \\ -x_1 + x_2 - 5x_3 \geq 30 \\ x_1, x_2, x_3 \geq 0 \end{cases}$$

Problem 2. (10pt) Below is the initial simplex tableau corresponding to a linear programming maximization problem. Find the initial maximization problem.

$$
\begin{array}{rrrrrrrr}
7 & 9 & 0 & 1 & 1 & 0 & 0 & 21 \\
-1 & 9 & 4 & 2 & 0 & -1 & 0 & 37 \\
1 & 0 & -1 & 3 & 0 & 0 & 1 & 46 \\
-5 & 4 & -6 & 1 & 0 & 0 & 0 & 0
\end{array}
$$

Problem 3. (10pt) Below is the final simplex tableau for a linear programming maximization problem.

0	9.3	0	0	-3.31	1	-1.23	-0.11	0.45	0	0	26.79
1	0.39	0	0	3.08	0	0.31	0.18	-0.14	0	0	27.37
0	0.68	1	0	-0.77	0	-0.08	0.05	0.07	0	0	5.1
0	-0.36	0	1	0.08	0	0.31	-0.07	0.11	0	0	28.87
0	-3.99	0	0	-6.46	0	0.15	-1.97	1.24	1	0	61.06
0	-1.79	0	0	-3.15	0	0.38	-1.37	0.29	0	1	31.27
0	2.78	0	0	9.62	0	3.46	0.34	0.47	0	0	355.67

(a) How many inequalities were considered?

(b) How many variables were there in the original inequalities?

(c) How many slack/surplus variables were introduced?

(d) What was the solution to this maximization problem?

Problem 4. (10pt) Below is the final simplex tableau for a linear programming minimization prob-
lem.

$$
\begin{array}{ccccc}
0 & 1 & 0.5 & -0.25 & 0.25 \\
1 & 0 & -0.25 & 0.38 & 0.63 \\
0 & 0 & 4.75 & 1.38 & 13.63
\end{array}
$$

(a) How many inequalities were considered?

(b) How many variables were there in the original inequalities?

(c) How many slack/surplus variables were introduced?

(d) What was the solution to this minimization problem?