Department of Mathematical Sciences
CARNEGIE MELLON UNIVERSITY

OPERATIONS RESEARCH II 21-393

Homework 3: Due Monday October 13.

1. A cloth manufacturer sells rolls of cloth in n widths $\ell_1, \ell_2, \ldots, \ell_n$. Production is only in widths of width L. The manufacturer has to meet demand for d_j rolls of width ℓ_j and these must be cut from the larger rolls. For example if $\ell_1 = 7$ and $\ell_2 = 5$ and $L = 36$ then the manufacturer can cut 4 rolls of width 7 and 1 roll of width 5 from one large roll, leaving 3 feet of waste.

   The manufacturer wishes to meet demand and minimise total waste. Write an Integer Programming Formulation for this problem. The manufacturer will have to cut up several rolls in several differnt ways to solve this problem.

2. Solve the following problem by a cutting plane algorithm:

$$
\begin{array}{llllll}
\text{minimise} & 4x_1 & + & 5x_2 & +3x_3 \\
\text{subject to} \\
& 2x_1 & + & x_2 & -x_3 & \geq & 2 \\
& x_1 & + & 4x_2 & +x_3 & \geq & 13
\end{array}
$$

$$x_1, x_2, x_3 \geq 0 \text{ and integer.}$$

3. Solve the following problem by a branch and bound algorithm:

$$
\begin{array}{lllll}
\text{Maximise} & x_1 & +2x_2 \\
\text{subject to} \\
& 2x_1 & +x_2 & \leq 7 \\
& -x_1 & +x_2 & \leq 3
\end{array}
$$

$$x_1, x_2 \geq 0.$$

$$x_1, x_2 \text{ integer.}$$