Print out your MATLAB codes and solutions to the given problems. You do not have to print out the coefficient matrices and right-hand sides.

1) (3 pts) Solve the linear system

$$\begin{aligned} x + y - z &= 1 \\ x + z - 2y &= 3 \\ 2x + 3y + 4 &= z \end{aligned}$$

Check your solution by verifying that the norm of the *residual vector* $r = A\bar{x} - \bar{b}$ is zero.

2) (2 pts) If you write the linear system

$$\begin{aligned} x + 2y + 3z &= 1 \\ 4x + 5y + 6z &= 3 \\ 7x + 8y + 9z &= 0 \end{aligned}$$

in matrix vector form, you should recognize an old friend that we have seen many times before. Solve this linear system. Why is our old friend potentially evil?

3) (8 pts) The problem in the Figure 1 below describes the forces in a simple bridge truss structure. Solve the linear system for the indicated forces (use $\alpha = \dfrac{1}{\sqrt{2}}$). Which forces are greatest and least (in magnitude)?

It is a really bad idea to try and create a single, giant 13×13 coefficient matrix. Instead, create the matrix row by row. For example, the first equation (in standard form) is

$$f_2 - f_6 = 0.$$

This means that for your first equation (*i.e.,* the first row of A) you will have 1 in column 2 and a -1 in column 6; the right-hand side vector will have a 0 in row 1. You can do this in MATLAB using

```
A(1,:) = [0 1 0 0 0 -1 0 0 0 0 0 0 0];
bvec(1) = 0;
```

Set up the remaining equations in a similar way.

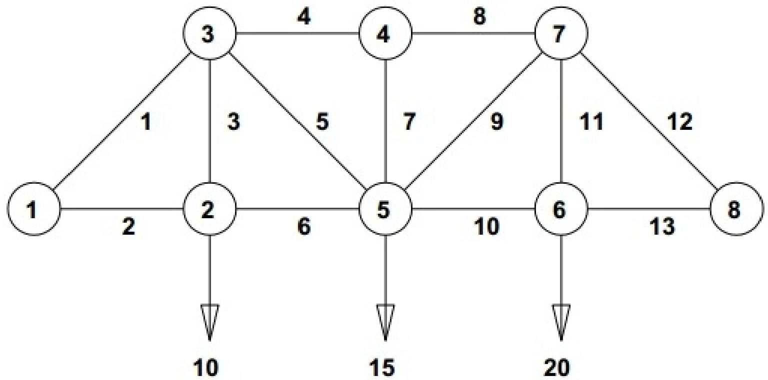

Figure 2.6. *A plane truss.*

$$
\begin{aligned}
&\text{Joint 2:} & f_2 &= f_6, \\
& & f_3 &= 10; \\
&\text{Joint 3:} & \alpha f_1 &= f_4 + \alpha f_5, \\
& & \alpha f_1 + f_3 + \alpha f_5 &= 0; \\
&\text{Joint 4:} & f_4 &= f_8, \\
& & f_7 &= 0; \\
&\text{Joint 5:} & \alpha f_5 + f_6 &= \alpha f_9 + f_{10}, \\
& & \alpha f_5 + f_7 + \alpha f_9 &= 15; \\
&\text{Joint 6:} & f_{10} &= f_{13}, \\
& & f_{11} &= 20; \\
&\text{Joint 7:} & f_8 + \alpha f_9 &= \alpha f_{12}, \\
& & \alpha f_9 + f_{11} + \alpha f_{12} &= 0; \\
&\text{Joint 8:} & f_{13} + \alpha f_{12} &= 0.
\end{aligned}
$$

Figure 1: Bridge truss for Problem 3.