1. (15 pts) What are signals and systems? For each example below, identify the input \(x\), system \(H\{\}\), and output \(y\). Which of \((x, H, y)\) are known \(a \text{ priori}\), which would need to be calculated or designed?
   
   a) radiosurgery
   b) medical magnetic resonance imaging
   c) reflection seismology
   d) a digital camera
   e) Facebook user experiments (6/14)

2. (18 pts) For \(f(t) = [u(t) - r(t - 1)]u(2 - t)\), sketch:
   a) \(f(t)\)
   b) \(f(\frac{t}{2})\)
   c) \(f(\frac{3}{2}t + 1)\)
   d) \(f(-\frac{3}{2}t + 1)\)
   e) \(f(3[-\frac{1}{2}t + 1])\)
   f) \(f(t)\Pi(t - 1)\)

3. (10 pts) Show that the following functions have the two properties of the unit impulse, i.e. #1: \(\delta(t - t_o) = 0\) for \(t\) not equal \(t_o\) and #2: \(\int_{-\infty}^{\infty} \delta(t)dt = 1\)
   a) \(\delta_1(t) = \lim_{a \to \infty} \frac{\alpha}{2}e^{-\alpha|t|}\)
   b) \(\delta_2(t) = \lim_{a \to 0} \frac{1}{2a}\Pi(\frac{t-a}{2a})\)

4. (12 pts) Complex review. Given \(z = x + jy = re^{j\theta}\). Derive the following relations:
   a. \(zz^* = r^2\)
   b. \(\frac{z}{z^*} = e^{j2\theta}\)
   c. \((z_1z_2)^* = z_1^*z_2^*\)
   d. \((\frac{z_1}{z_2})^* = \frac{z_1^*}{z_2^*}\)

5. (8 pts) Express the following as the sum of an odd and an even function, and sketch the functions:
   a) \(u(t)\)
   b) \(\cos(2\pi t)u(t)\)

6. (20 pts) For each of the following impulse responses, determine whether the system is BIBO stable. If the system is not BIBO stable, find a bounded input \(x(t)\) or \(x[n]\) which gives an unbounded output, and show that the output is unbounded for this input.
   a. \(h(t) = e^t u(t)\)
   b. \(h(t) = (t - 1)^2 e^{(1-t)} u(t)\)
   c. \(h[n] = u[n - 4]\)
   d. \(h[n] = \cos(2\pi n) u[n]\)
   e. \(h(t) = \sum_{n = -\infty}^{\infty} \delta(t - 2n)\)

7. (18 pts) Compute and sketch the output \(y(t) = x(t) * h(t)\) for the following input and impulse response pairs:
   a. \(x(t) = \Pi(t - 1)\)
   b. \(x(t) = e^{-t} u(t)\)
   c. \(x(t) = \sum_{n = -\infty}^{\infty} \delta(t - \frac{1}{2} - n)\)

Note: \(\Pi(t) = u(t + \frac{1}{2}) - u(t - \frac{1}{2})\), and \(r(t) = tu(t)\) where \(u(t)\) is the unit step.