EE 204 Signals and Systems Laboratory 3

I. PREPARATION

A. *Please study the followings,*

Unit Step:
$function\ y = u(t)$
$y = (t \geq 0);$

Ramp:
$function\ r = ramp(t)$
$r = t. * (t \geq 0);$

Impulse:
$function\ y = imp(t)$
$y = (t == 0);$

Rectangle:
$function\ y = rect(t)$
$y = u(t + 0.5) - u(t - 0.5);$

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Discrete time Step:
function y = stepDT(n)
   y = zeros(size(n));
   y(n >= 0) = 1;
   ss = find(round(n) ~= n);
   if(~isempty(ss))
      y(ss) = NaN;
   end
end
```

```
Discrete time impulse :
function y = impDT(n)
   y = zeros(size(n))
   y(n == 0) = 1;
   ss = find(round(n) ~= n);
   if(~isempty(ss))
      y(ss) = NaN;
   end
end
```

```
Discrete time ramp :
function y = rampDT(n)
   y = zeros(size(n));
   y(n >= 0) = n(n >= 0);
   ss = find(round(n) ~= n);
   if ~isempty(ss)
      y(ss) = NaN;
   end
end
```

B. *Please do the followings,*

1) Draw the following signals by hand.
$a)\ s1(t) = u(t-1)$
$b)\ s2(t) = u(2t+4)$
$c)\ s3(t) = u(3t+1) + u(t-1) + u(t-3) + 3u(t-5)$
$d)\ s4(t) = r(t+1)$
$e)\ s5(t) = r(t+1) - 2r(t) + r(t-1)$
$f)\ s6(t) = r(t-1) - 2r(t-4)$
$g)\ s7(t) = \delta(2t-1) + \delta(3t-2) + \delta(4t+3) + \delta(2t-4)$
$h)\ s8(t) = u(t-2) + \delta(t-1) + u(t+4)$
$j)\ s9(t) = u(t+1) + \delta(t-2)$

2) Draw the following discrete time signals by hand.
$a)\ s1[n] = \delta[n-2]$
$b)\ s1[n] = \delta[n-2] + \delta[2n-6] + \delta[n-2] + \delta[n-2]$
$c)\ s3[n] = u[n-2] - u[n-5]$
$d)\ s4[n] = u[n-2] + \delta[n-5]$
$e)\ s5[n] = \delta[n-2]n^2 + u[n-2] + 1$
$f)\ s6[n] = r[n] - 2r[n-2] + r[n-4]$

II. EXPERIMENT

1) Draw the following discrete time signals using matlab
$a)\ s1[n] = \delta[n-3]$
$b)\ s1[n] = \delta[2n-2] + \delta[2n-6] + \delta[2n-10] + \delta[n-8]$
$c)\ s3[n] = u[n+2] - u[n-5]$
$d)\ s4[n] = u[n+2] + \delta[n-5]$
$e)\ s5[n] = \delta[n-3]n^2 + u[n-4]$
$f)\ s6[n] = r[n] - 2r[n-2] + r[n-4]$
$f)\ s7[n] = r[n+2] - 2r[n-2] + r[n-6]$

2) Also draw the following continuous time signals using Matlab

a) $s_1(t) = u(t-2) + \delta(t-5)$

b) $s_2(t) = u(t+1) + \delta(t) - u(t-3) + r(t-6)$

c) $s_3(t) = u(t) + u(t-1) - 3\delta(t-5) + u(t-8) - 3u(t-10)$

d) $s_4(t) = r(t) - 3r(t-4) - \delta(t-6) + u(t-8)t$

e) $s_5(t) = 2u(t+2) + u(t) + 5\delta(t-3) - \delta(t-5)t^2$

3) Draw the following signals in Matlab:

$$x_1(t) = e^{-t^2}u(t) - r(t)t^2$$

$$x_2[n] = \cos(n)u(n)n^2$$

4) Consider the following piecewise function:

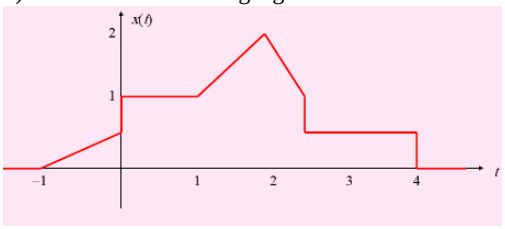
$$f(t) = \begin{cases} 0, & t < -\epsilon \\ \frac{1}{2\epsilon}t, & -\epsilon < t < \epsilon \\ 1, & t > \epsilon \end{cases}$$

Show that when ϵ goes to zero, this function converges to the unit step function.

5) Draw the following signal in Matlab step by step:

$$f = r(-t) - r(-t-2) - 2u(-t-2) + \delta(t)$$

6) Consider the following signal:



Draw this signal in Matlab step by step.

7) Draw the following piecewise function:

$$f = \begin{cases} \sin(t) & t \leq -10 \\ \delta(t) & -10 \leq t \leq 10 \\ u(t) & t \geq 10 \end{cases}$$