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LSS Lab 13 - Section C2 7/17/2017

```
close all; clc; clear;
```

Problem 1

```
syms z

% 1.1
x = [5 4 3 2 1];
n = [0:4];
X = sum(x.*(z.^-n))
% X = 4/z + 3/z^2 + 2/z^3 + 1/z^4 + 5

% 1.2
x = [5 4 3 2 1];
n = [-2:2];
X = sum(x.*(z.^-n))
% X = 4*z + 2/z + 1/z^2 + 5*z^2 + 3

% 1.3
syms n
x = n.*heaviside(n);
X = ztrans(x);
X = simplify(X)
% X = z/(z - 1)^2

% 1.4
x = 1./(n+3).*heaviside(n+2);
X = ztrans(x);
X = simplify(X)
% X = -(z*(2*z + 2*z^2*log(1 - 1/z) + 1))/2
```

```
X =

4/z + 3/z^2 + 2/z^3 + 1/z^4 + 5
```

```
X =
```

```
4*z + 2/z + 1/z^2 + 5*z^2 + 3
```

```
X =
```

```
z/(z - 1)^2
```

```
X =
```

```
-(z*(2*z + 2*z^2*log(1 - 1/z) + 1))/2
```

Problem 2

```
syms z n

% 2.1
x = 2.^n;
X = ztrans(x);
X = simplify(X)
% X = z/(z - 2)

% 2.2
x = 2.^n.*cos(n);
X = ztrans(x);
X = simplify(X)
% X = (z*(z - 2*cos(1)))/(z^2 - 4*cos(1)*z + 4)

% 2.3
x = 2.^n.*sin(n);
X = ztrans(x);
X = simplify(X)
% X = (2*z*sin(1))/(z^2 - 4*cos(1)*z + 4)

% 2.4
x = 2.^n.*exp(2*j*n);
X = ztrans(x);
X = simplify(X)
% X = z/(2*(z/2 - exp(2i)))
```

```
X =
```

```
z/(z - 2)
```

```
X =
```

```
(z*(z - 2*cos(1)))/(z^2 - 4*cos(1)*z + 4)
```

```
X =

(2*z*sin(1))/(z^2 - 4*cos(1)*z + 4)


X =

z/(2*(z/2 - exp(2i)))
```

Problem 3

```
syms z n

% 3.1
X = 1;
x = iztrans(X,z);
x = kroneckerDelta(z, 0)
% kroneckerDelta(z,0) returns 1 if z == 0 and 0 if z ~= 0.


% 3.2
X = z./(z-1);
x = iztrans(X)
% x = 1

% 3.3
X = z./(z-1).^2;
x = iztrans(X)
% x = n

% 3.4
X = 3.*z./(z-3).^2;
x = iztrans(X)
% x = 3^n + 3^n*(n - 1)


x =

kroneckerDelta(z, 0)


x =

1


x =

n


x =
```

```
3^n + 3^n*(n - 1)
```

Problem 4

```
syms z

% 4.1a
% (z^2 - 8)/(z^3-8z^2+5z+2)
num = [1 0 -8];
den = [1 -8 5 2];
[have, a, great] = residue(num,den);
summer1a = have(1)/(z-a(1))+have(2)/(z-a(2))+have(3)/(z-a(3))

% 4.1b
[num, den] = residue(have, a, great)
num = num(1)*z.^(2)+0*z.^(1)+num(3)*z.^(0);
den = den(1)*z.^(3)+den(2)*z.^(2)+den(3)*z.^(1)+den(4)*z.^(0);
summer1b = num/den

% % 4.2a
% (z^3 - 8z)/(z^3-8z^2+5z+2)
num = [1 0 -8 0];
den = [1 -8 5 2];
[have, a, great] = residue(num,den);
summer2a = have(1)/(z-a(1))+have(2)/(z-a(2))+have(3)/(z-a(3))+great

% 4.2b
[num, den] = residue(have, a, great)
num = num(1)*z.^(0)+0*z.^(-1)+num(3)*z.^(-2)+0*z.^(-3)
den = den(1)*z.^(0)+den(2)*z.^(-1)+den(3)*z.^(-2)+den(4)*z.^(-3);
summer2b = num/den

% 4.3a
% (z^2 - 8)/(z^3-8z^2+5z+2)
num = [1 0 -8];
den = [1 -8 5 2];
[have, a, great] = residue(num,den);
summer3a = have(1)/(z-a(1))+have(2)/(z-a(2))+have(3)/(z-a(3))

% 4.3b
[num, den] = residue(have, a, great)
num = num(1)*z.^(-1)+0*z.^(-2)+num(3)*z.^(-3)+0*z.^(-4);
den = den(1)*z.^(0)+den(2)*z.^(-1)+den(3)*z.^(-2)+den(4)*z.^(-3);
summer3b = num/den


summer1a =

7/(8*(z - 1)) + 8541356040669535/(9007199254740992*(z
 - 511926788601467/70368744177664)) - 7415456133826903/
(9007199254740992*(z + 4952468315601631/18014398509481984))
```

```
num =

    1.0000    0.0000   -8.0000


den =

    1.0000   -8.0000    5.0000    2.0000


summer1b =

(z^2 - 8)/(z^3 - 8*z^2 + 5*z + 2)


summer2a =

7/(8*(z - 1)) + 7767207265277589/(1125899906842624*(z
 - 511926788601467/70368744177664)) + 8154546271235463/
(36028797018963968*(z + 4952468315601631/18014398509481984)) + 1


num =

    1.0000   -0.0000   -8.0000    0.0000


den =

    1.0000   -8.0000    5.0000    2.0000


num =

1 - 8/z^2


summer2b =

-(8/z^2 - 1)/(5/z^2 - 8/z + 2/z^3 + 1)


summer3a =

7/(8*(z - 1)) + 8541356040669535/(9007199254740992*(z
 - 511926788601467/70368744177664)) - 7415456133826903/
(9007199254740992*(z + 4952468315601631/18014398509481984))


num =

    1.0000    0.0000   -8.0000
```

```
den =

    1.0000   -8.0000    5.0000    2.0000

summer3b =

(1/z - 8/z^3)/(5/z^2 - 8/z + 2/z^3 + 1)
```

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