PROJECT 1
TRANSFER FUNCTION REDUCTION

Date: 01 - 02 - 2022

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OBJECTIVE:

The objective of this exercise is to use the building blocks for block-diagram algebra for transfer functions developed in question 1., and to perform basic analysis. Using the program/programs developed in question 1., determine the overall transfer function for the figure shown below. The individual transfer functions are as follows:

QUESTION 1

Code:

```
% Block diagram algebra
%determine the overall transfer functions
%take off point move to right side always
% Define systems functions

% FORWARD PATH
numG1=[0 1];
demG1=[1 10];

numG2=[0 1];
demG2=[1 1];

numG3=[1 0 1];
demG3=[1 4 4];

numG4=[1 1];
demG4=[1 6];
```

```
%FEEDBACK PATH
numH1=[1 1];
demH1=[1 2];

numH2=[0 2];
demH2=[0 1];

numH3=[0 1];
demH3=[0 1];

% moving the take off point
% Generating transfer function of the given system using above poly
g1=tf(numG1,demG1);
g2=tf(numG2,demG2);
g3=tf(numG3,demG3);
g4=tf(numG4,demG4);

h1=tf(numH1,demH1);
h2=tf(numH2,demH2);
h3=tf(numH3,demH3);

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step_1=series(h2,1/g4)
step_1b=series(g3,g4)
step_2=feedback(step_1b,-1*h1)
step_3=series(step_2,g2)
step_4=feedback(step_3,-1*step_1)
step_5=series(step_4,g1)
```
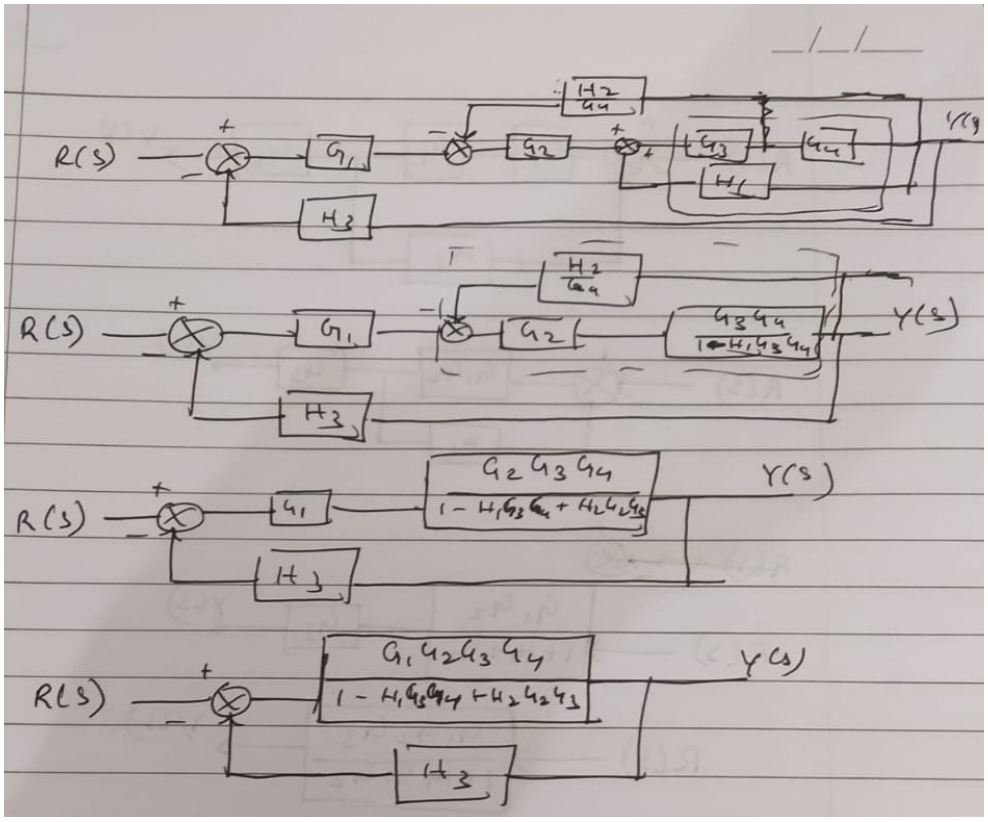
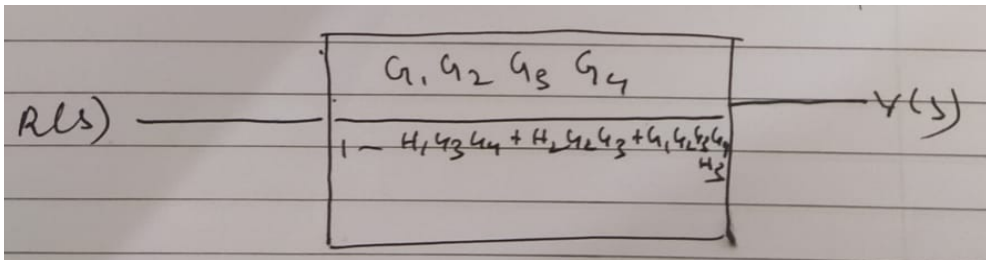

```
step_6=feedback(step_5,h3)
```





```
NAME = "JACOB V SANOJ"
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step_1 =

  2 s + 12
  --------
   s + 1

Continuous-time transfer function.
step_1b =

     s^3 + s^2 + s + 1
  ------------------------
  s^3 + 10 s^2 + 28 s + 24

Continuous-time transfer function.
step_2 =

  s^4 + 3 s^3 + 3 s^2 + 3 s + 2
  -----------------------------
   10 s^3 + 46 s^2 + 78 s + 47

Continuous-time transfer function.
step_3 =

      s^4 + 3 s^3 + 3 s^2 + 3 s + 2
  -------------------------------------
  10 s^4 + 56 s^3 + 124 s^2 + 125 s + 47

Continuous-time transfer function.
step_4 =

       s^5 + 4 s^4 + 6 s^3 + 6 s^2 + 5 s + 2
  -----------------------------------------------
  8 s^5 + 48 s^4 + 138 s^3 + 207 s^2 + 132 s + 23

Continuous-time transfer function.
step_5 =

              s^5 + 4 s^4 + 6 s^3 + 6 s^2 + 5 s + 2
  ---------------------------------------------------------------
  8 s^6 + 128 s^5 + 618 s^4 + 1587 s^3 + 2202 s^2 + 1343 s + 230

Continuous-time transfer function.
step_6 =

              s^5 + 4 s^4 + 6 s^3 + 6 s^2 + 5 s + 2
  ---------------------------------------------------------------
  8 s^6 + 129 s^5 + 622 s^4 + 1593 s^3 + 2208 s^2 + 1348 s + 232

Continuous-time transfer function.
```

QUESTION 2

Code:

```
clc;

g11=[0 1];

g1_d=[1 1];
```

```
g22=[0 1];

g2_d=[1 3];
```

```
g33=[0 1];

g3_d=[1 0];
```

```
h11=[0 1];

h1_d=[0 1];
```

```
g1s=tf(g11,g1_d)
g2s=tf(g22,g2_d)
g3s=tf(g33,g3_d)
h1s=tf(h11,h1_d)
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```
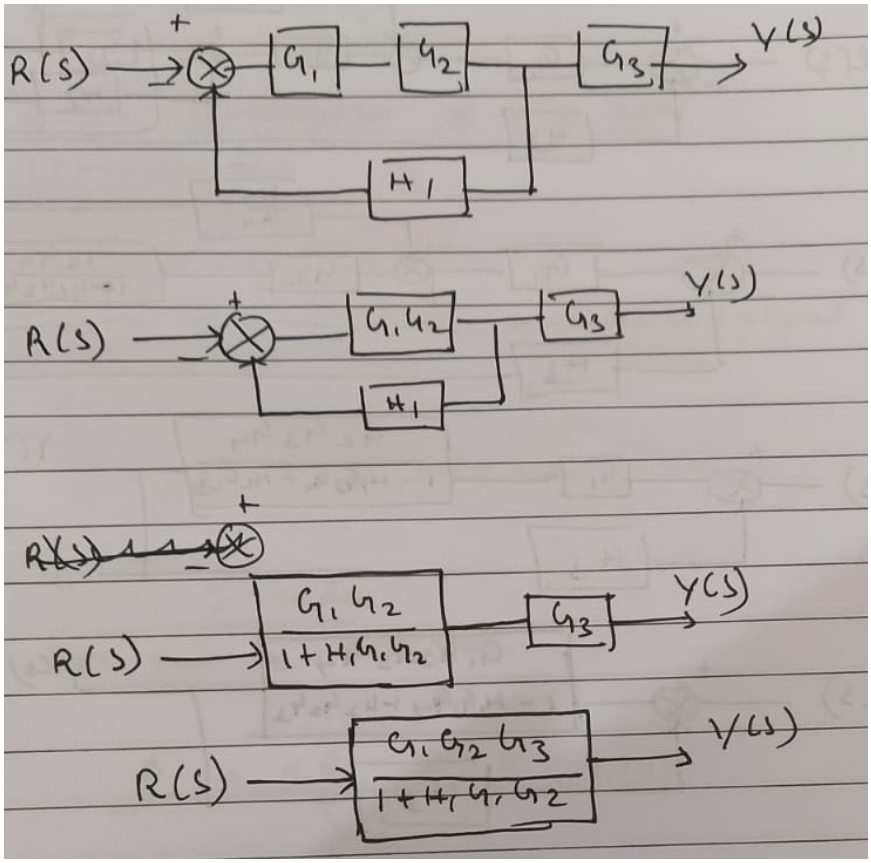

```
step_11=series(g1s,g2s)
step_22=feedback(step_11,h1s)
final=series(step_22,g3s)
```



```
g1s =

    1
  -----
  s + 1

Continuous-time transfer function.
g2s =

    1
  -----
  s + 3

Continuous-time transfer function.
g3s =

  1
  -
  s

Continuous-time transfer function.
h1s =

  1

Static gain.
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step_11 =

        1
  -------------
  s^2 + 4 s + 3

Continuous-time transfer function.
step_22 =

        1
  -------------
  s^2 + 4 s + 4

Continuous-time transfer function.
final =

         1
  -----------------
  s^3 + 4 s^2 + 4 s

Continuous-time transfer function.
```