CSE350

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Sec: 07

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Report

1. Yes, we can get output higher than 15V in D2A converters. In case of the binary weighted one, we can get the desired output by increasing the value of the input bits, the voltage sources and the RF resistance and also by decreasing the value of the resistance connected to each input.

In case of the R and 2R one, we can increase the value of the input bits, the voltage sources, the RL resistance and decrease the value of R and RL to get output higher than 15V.

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2.

For D2A converter using Binary-Weighted Resistors,

the full step output is -7.5 V

and resolution is 0.5 V

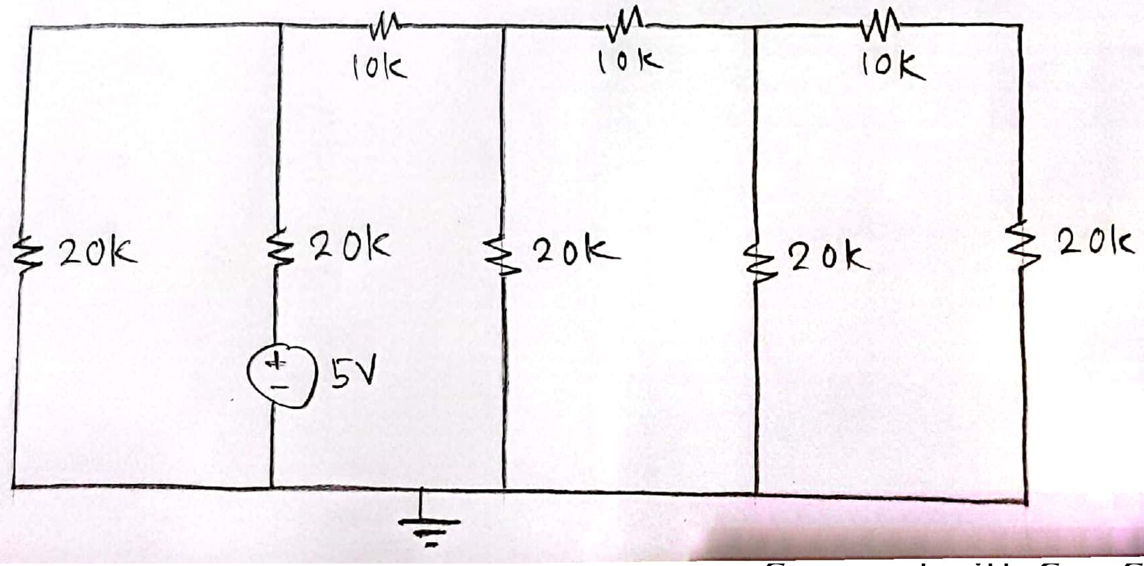
For D2A converter with R and 2R Resistors,

the full step output is -9.4V

and resolution is 0.62 V

3.

I am selecting the binary value 0001 i.e. only A is 5V and others are 0V.



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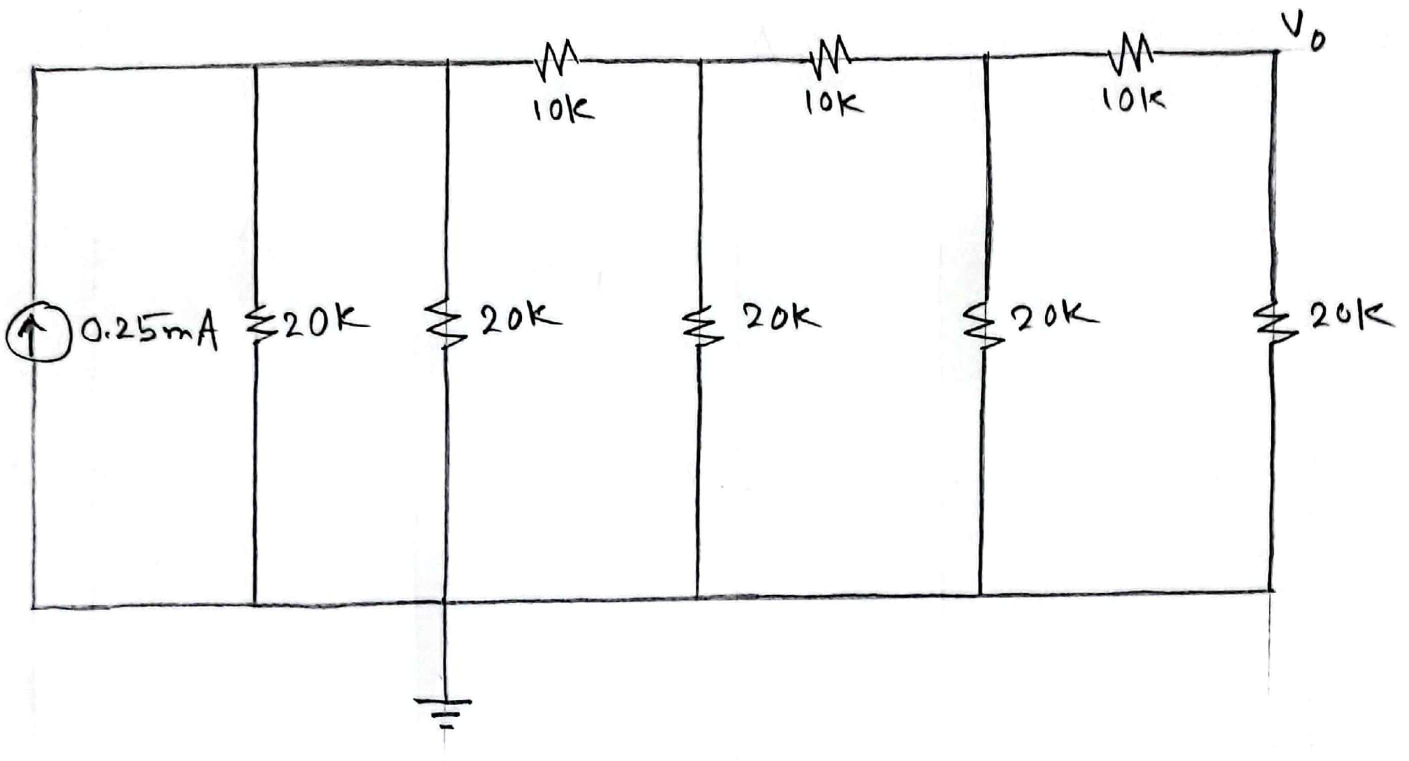
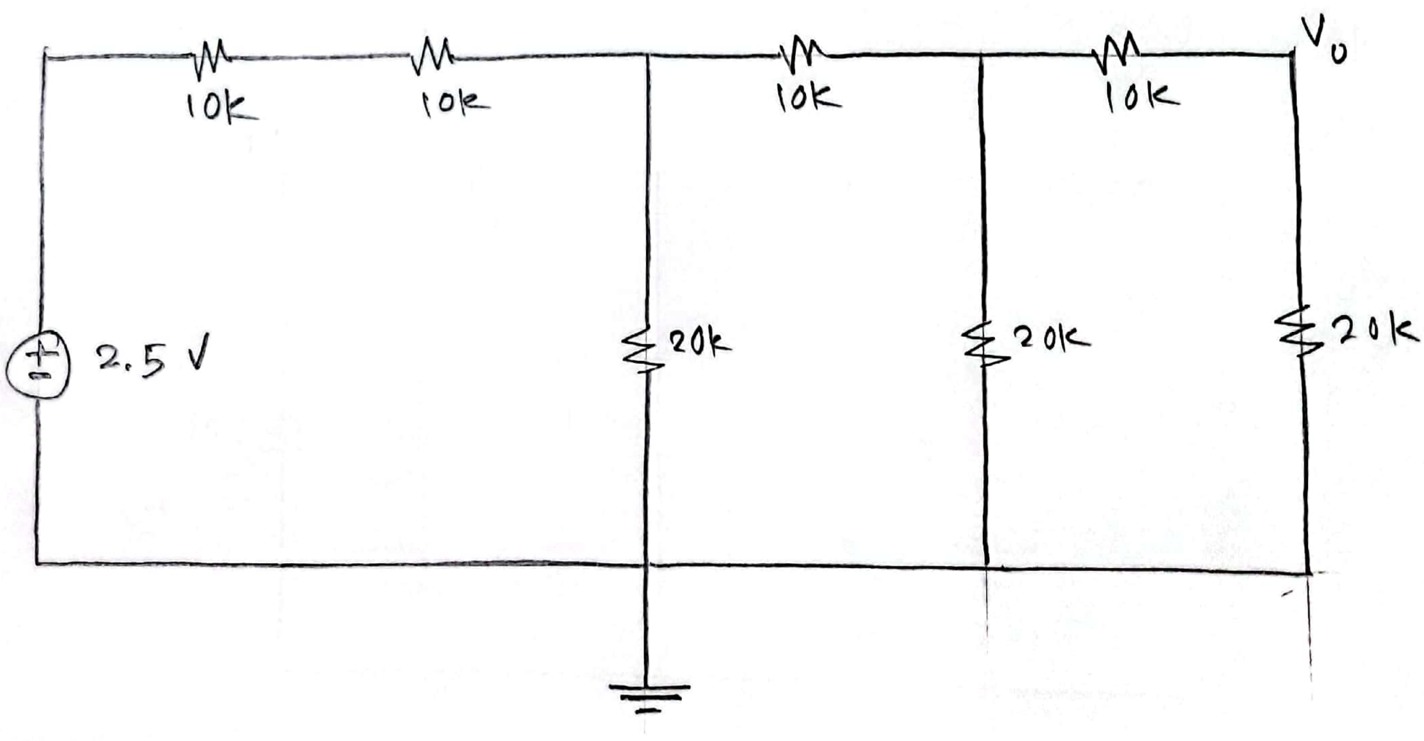
$$I = \frac{5}{20} = 0.25\,mA$$



$$R = \left(\frac{1}{20} + \frac{1}{20}\right)^{-1} = 10k\Omega$$

$$V = 0.25 \times 10 = 2.5V$$



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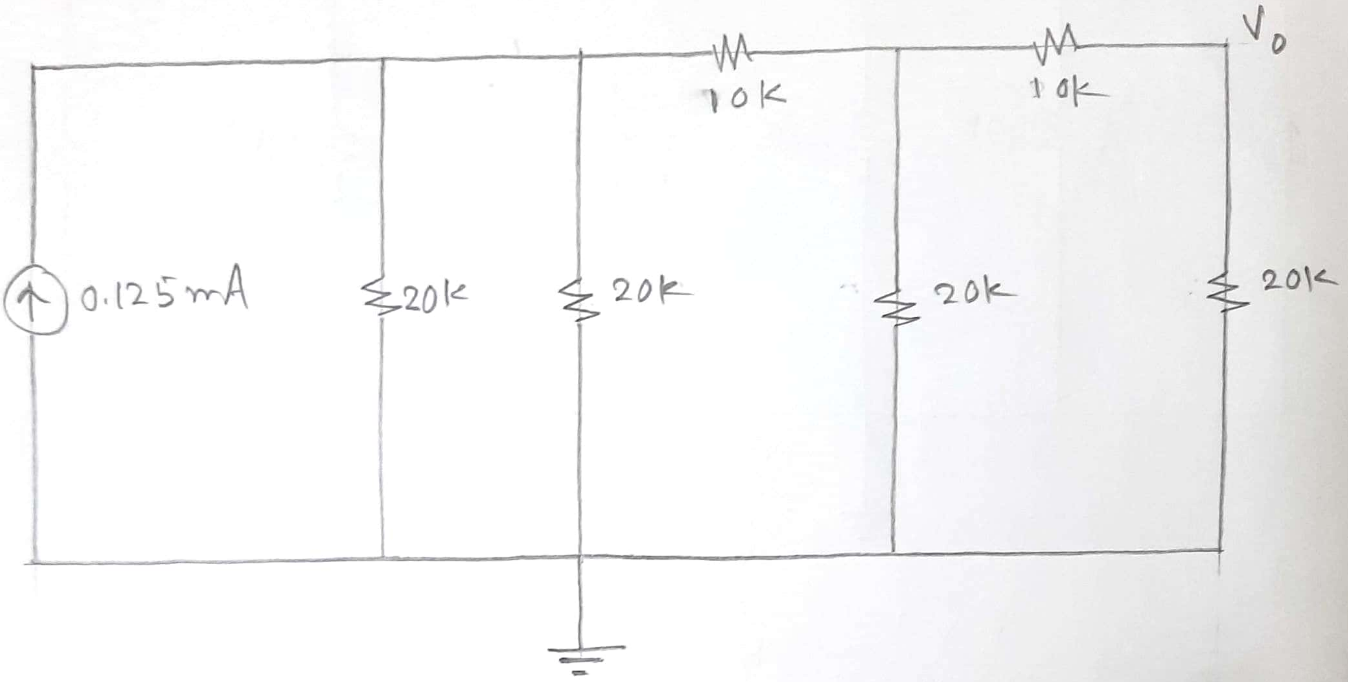
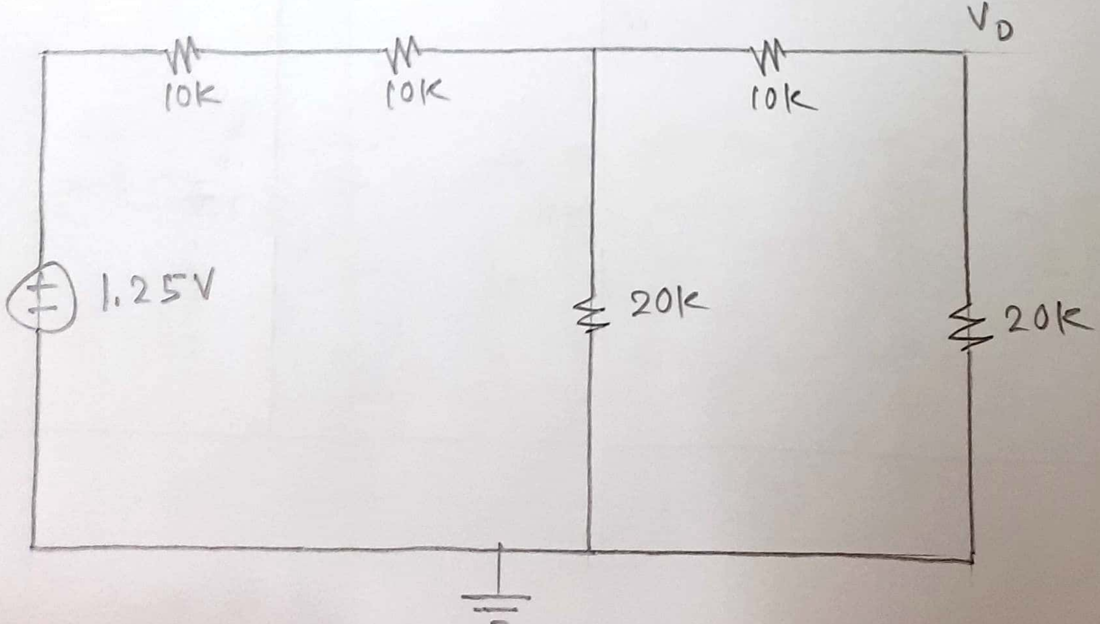
$R = (10+10) = 20k\Omega$

$I = \frac{0.25}{20} = 0.125\ mA$



$R = \left(\frac{1}{20} + \frac{1}{20}\right)^{-1} = 10k\Omega$

$V = 0.125 \times 10 = 1.25\ V$



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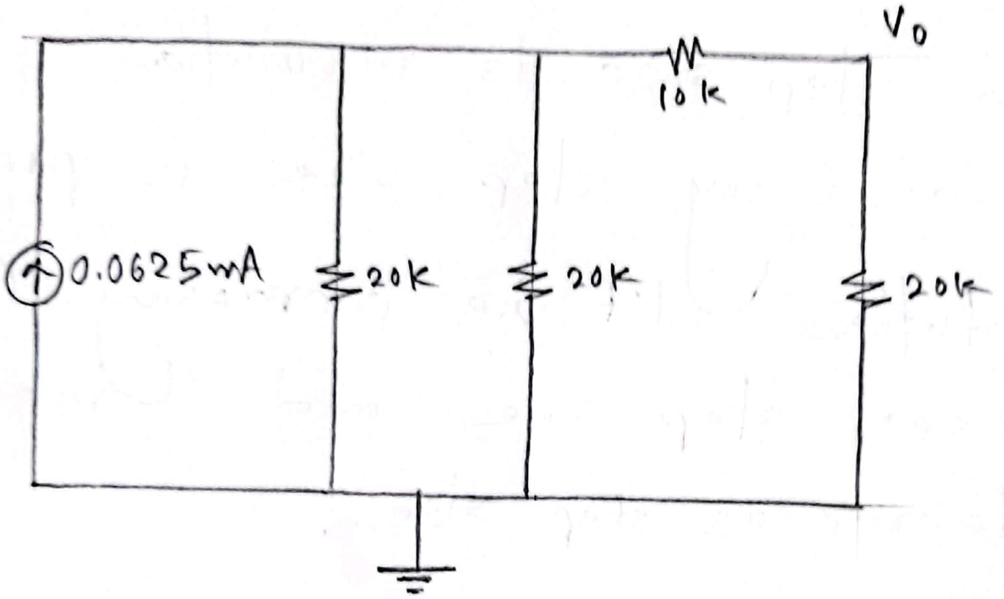
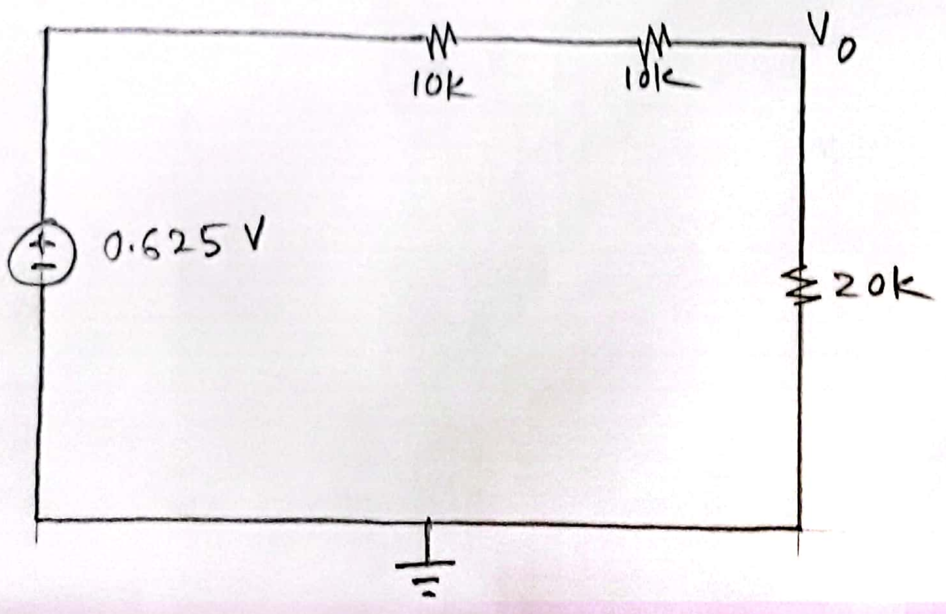
$R = (10+10) = 20k\Omega$

$I = \frac{1.25}{20} = 0.0625\ mA$



$R = \left(\frac{1}{20} + \frac{1}{20}\right)^{-1} = 10k\Omega$

$V = 0.0625 \times 10 = 0.625\ V$



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4.

I am choosing circuit 1 and as the last two digits of my ID are 4 and 7, the sum will get me 11. So, for high input voltage the value is 11 V and for low input voltage the value is 0 V.

Datasheet for circuit 1:

Input configuration	D	C	B	A	Output Voltage, Vo(V)
1	0	0	0	0	0.00
2	0	0	0	1	-1.09
3	0	0	1	0	-2.19
4	0	0	1	1	-3.29
5	0	1	0	0	-4.39
6	0	1	0	1	-5.49
7	0	1	1	0	-6.59
8	0	1	1	1	-7.69
9	1	0	0	0	-8.79
10	1	0	0	1	-9.89
11	1	0	1	0	-10.99
12	1	0	1	1	-12.09
13	1	1	0	0	-13.19
14	1	1	0	1	-13.49
15	1	1	1	0	-13.49
16	1	1	1	1	-13.49

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5. We know,

$$\text{Resolution} = \left(\frac{RF}{RI}\right) V_{High}$$

and step size is resolution.

So, we can say step size is proportional to ~~resolution~~ RF i.e. increasing RF increases step size and decresing RF decreases step size.

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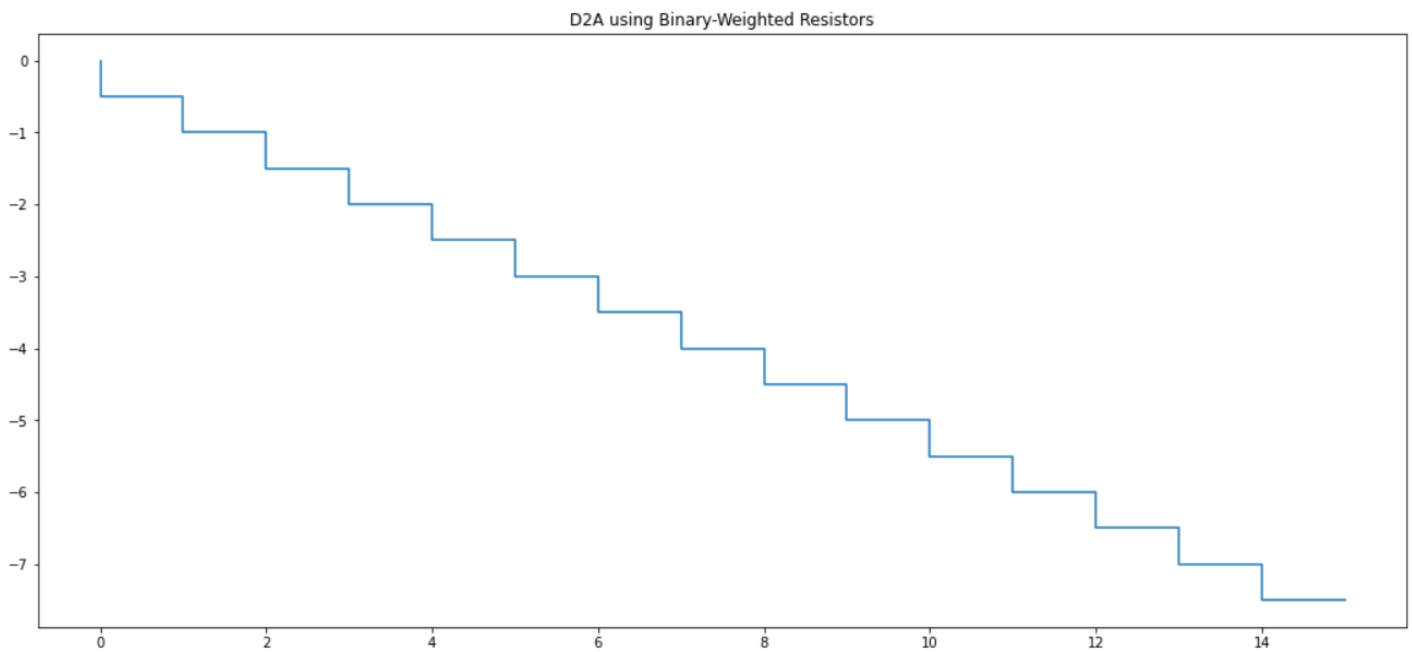
D2A using Binary-Weighted Resistors

```
import matplotlib.pyplot as plt
from pylab import rcParams
```

```
rcParams['figure.figsize'] = 18, 8

x = [0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15]
y = [-0, -0.5, -1, -1.5, -2, -2.5, -3, -3.5, -4, -4.5, -5, -5.5, -6, -6.5, -7, -7.5]

plt.title('D2A using Binary-Weighted Resistors')
plt.step(x, y)
plt.show()
```



D2A with R and 2R Resistors

```
rcParams['figure.figsize'] = 18, 8

x = [0,1,2,3,4,5,6,7,8,9,10,11,12,13,14,15]
y = [-0, -0.62, -1.24, -1.86, -2.49, -3.11, -3.74, -4.36, -4.99, -5.61, -6.24, -6.86, -7.49, -8.11, -8.74, -9.36]

plt.title('D2A with R and 2R resistors')
plt.step(x, y)
plt.show()
```