CSE350

DIGITAL ELECTRONICS AND PULSE TECHNIQUES

Lab- 04

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Section- 02

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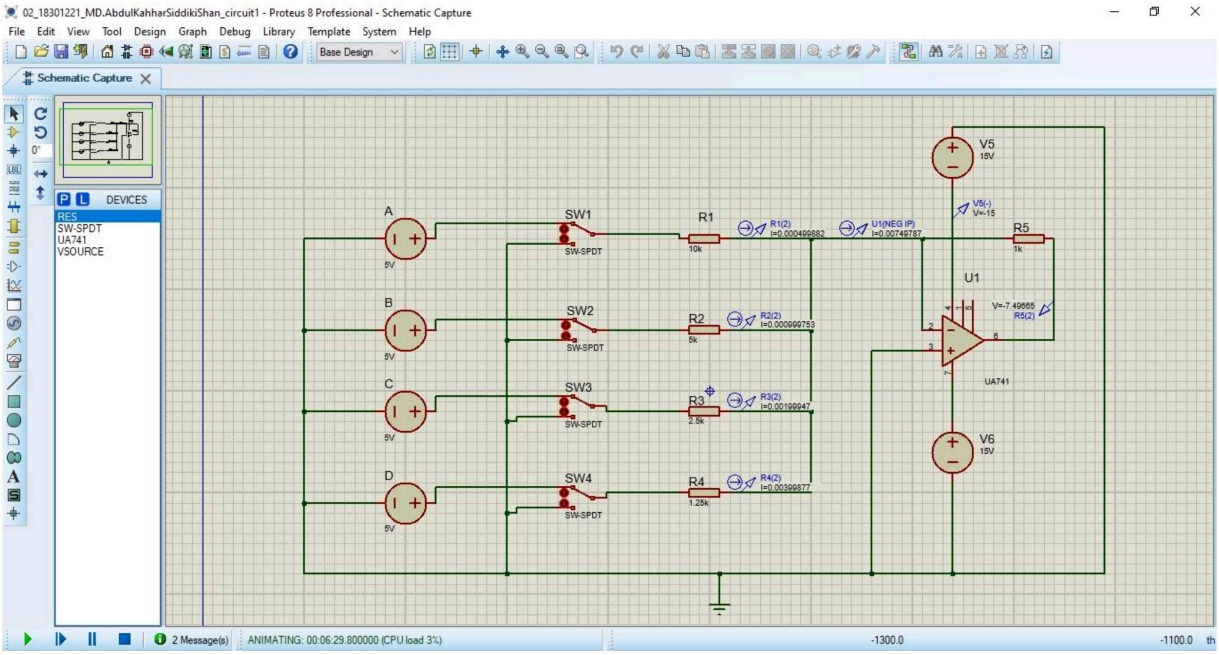
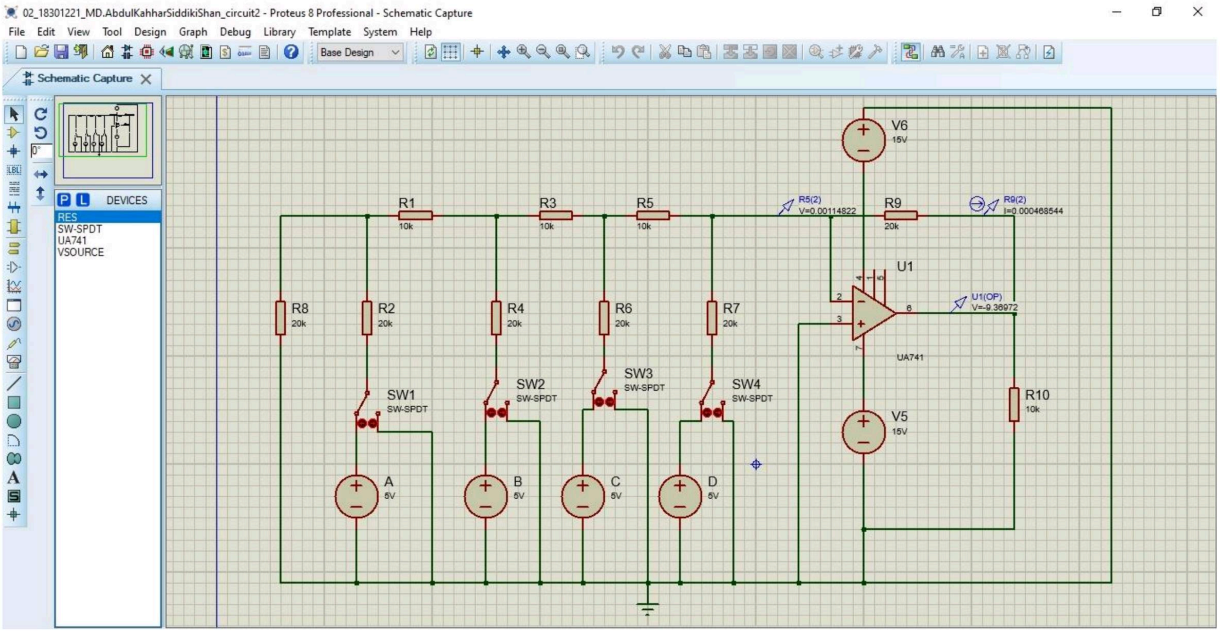
Binary-weighted registor



R and 2R Registor



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Datasheet for circuit-1

Input configuration	D	C	B	A	Output Voltage
1	0	0	0	0	0.002722
2	0	0	0	5	-0.4972
3	0	0	5	0	-0.99
4	0	0	5	5	-1.49
5	0	5	0	0	-1.99
6	0	5	0	5	-2.49
7	0	5	5	0	-2.99
8	0	5	5	5	-3.49
9	5	0	0	0	-3.99
10	5	0	0	5	-4.49
11	5	0	5	0	-4.99
12	5	0	5	5	-5.49
13	5	5	0	0	-5.99
14	5	5	0	5	-6.49
15	5	5	5	0	-6.99
16	5	5	5	5	-7.49

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Data sheet for circuit-2

Input Configuration	D	C	B	A	Output Voltage, V_O (V)
1	0	0	0	0	0.00495909
2	0	0	0	5	-0.62
3	0	0	5	0	-1.245
4	0	0	5	5	-1.869
5	0	5	0	0	-2.49
6	0	5	0	5	-3.119
7	0	5	5	0	-3.74
8	0	5	5	5	-4.3699
9	5	0	0	0	-4.99
10	5	0	0	5	-5.619
11	5	0	5	0	-6.24
12	5	0	5	5	-6.86
13	5	5	0	0	-7.49
14	5	5	0	5	-8.119
15	5	5	5	0	-8.744
16	5	5	5	5	-9.369

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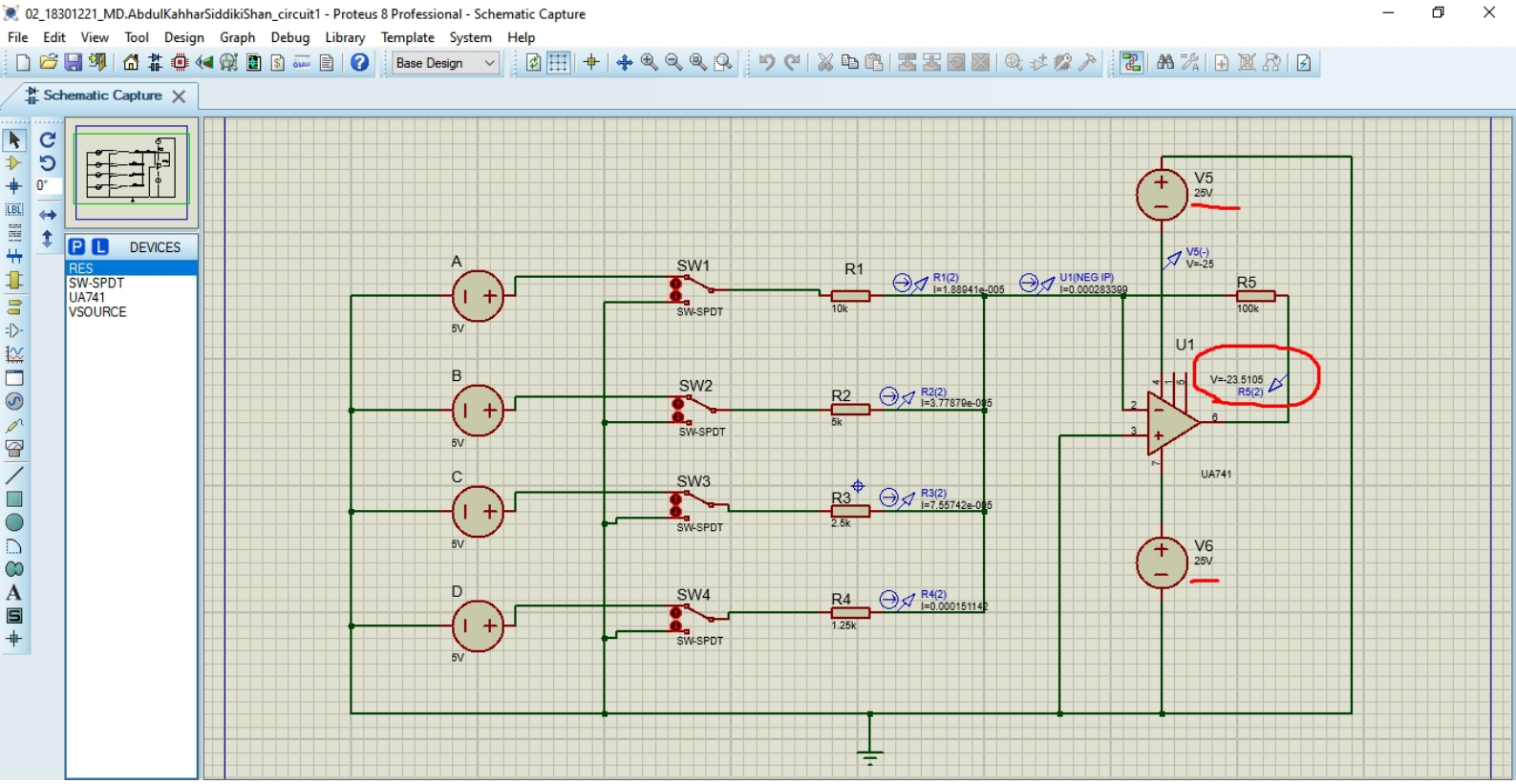
Report:

1. Can you get output higher than 15v in D2A converters? if so, how?

→ Yes, i can get output higher than 15V in D2A converter. To get it, i have to increase the value of RF resistor. That will not be enougough. I have to increase the input voltage of amplifier which added in 4 and 7 pin. If we increase that voltage, the output voltage will be more than 15V.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File Edit View Tool Design Graph Debug Library Template System Help
Base Design
Schematic Capture
DEVICES
RES
SW-SPDT
UA741
VSOURCE
A
B
C
D
5V
SW1
SW2
SW3
SW4
SW-SPDT
R1
10k
R2
5k
R3
2.5k
R4
1.25k
R5
100k
R1(2)
I=1.88941e-005
U1(NEG IP)
I=0.000283399
R2(2)
I=3.77879e-005
R3(2)
I=7.55742e-005
R4(2)
I=0.000151142
V5
25V
V5(-)
V=-25
U1
V=-23.5105
R5(2)
UA741
V6
25V

2. What is the full step output and resulation for both D2A converters.

→ Full step output for both D2A are;

Binary-Weighted Register → $\{(16-1) \times 0.5\} = 7.5$ V

For R and 2R → $\{(16-1) \times 0.62\} = 9.3$ V

Resulations stands for changing out put.

$$\text{Resulation} = \frac{R_f}{R_1} V_{High}$$

$$= \frac{1}{10} \times 5$$

$$= 0.5$$

Resulation for Binary-weighted resistor = 0.5

Resulation for R2R = 0.62

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3. Explain how you get the analogue output voltage of R2R D2A converters? Select one data entry and validate the data with necessary circuits and calculation.

$$V_o = -R_f\left\{\left(\frac{1}{R_1} \times V_A\right) + \left(\frac{1}{R_2} \times V_B\right) + \left(\frac{1}{R_3} \times V_C\right) + \left(\frac{1}{R_4} \times V_D\right)\right\}$$

Let, $V_A = 5$, $V_B = V_C = V_D = 0$

$$V_o = -1\left\{\left(\frac{1}{10} \times 5\right) + \left(\frac{1}{R_2} \times 0\right) + \left(\frac{1}{R_3} \times 0\right) + \left(\frac{1}{R_4} \times 0\right)\right\}$$

$$= -0.5$$

In the circuit calculation in proteus we got $0.49 \simeq 0.5$. So, the data is validate

For R2R:

$$V_{out} = \frac{1V_A + 2V_B + 4V_C + 8V_D}{2^n}$$

$$V_{out} = -\left(\frac{V_{ref} \times R_f}{R}\right) \sum_{i=0}^{i=N-1} \frac{B_i}{n^{N-i}}$$

$$\Rightarrow V_{out} = -\frac{\because 2R_f}{R_f}\left(\frac{V_A}{2^4} + \frac{V_B}{2^3} + \frac{V_C}{2^2} + \frac{V_D}{2^1}\right)$$

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When, ~~A = 5V~~

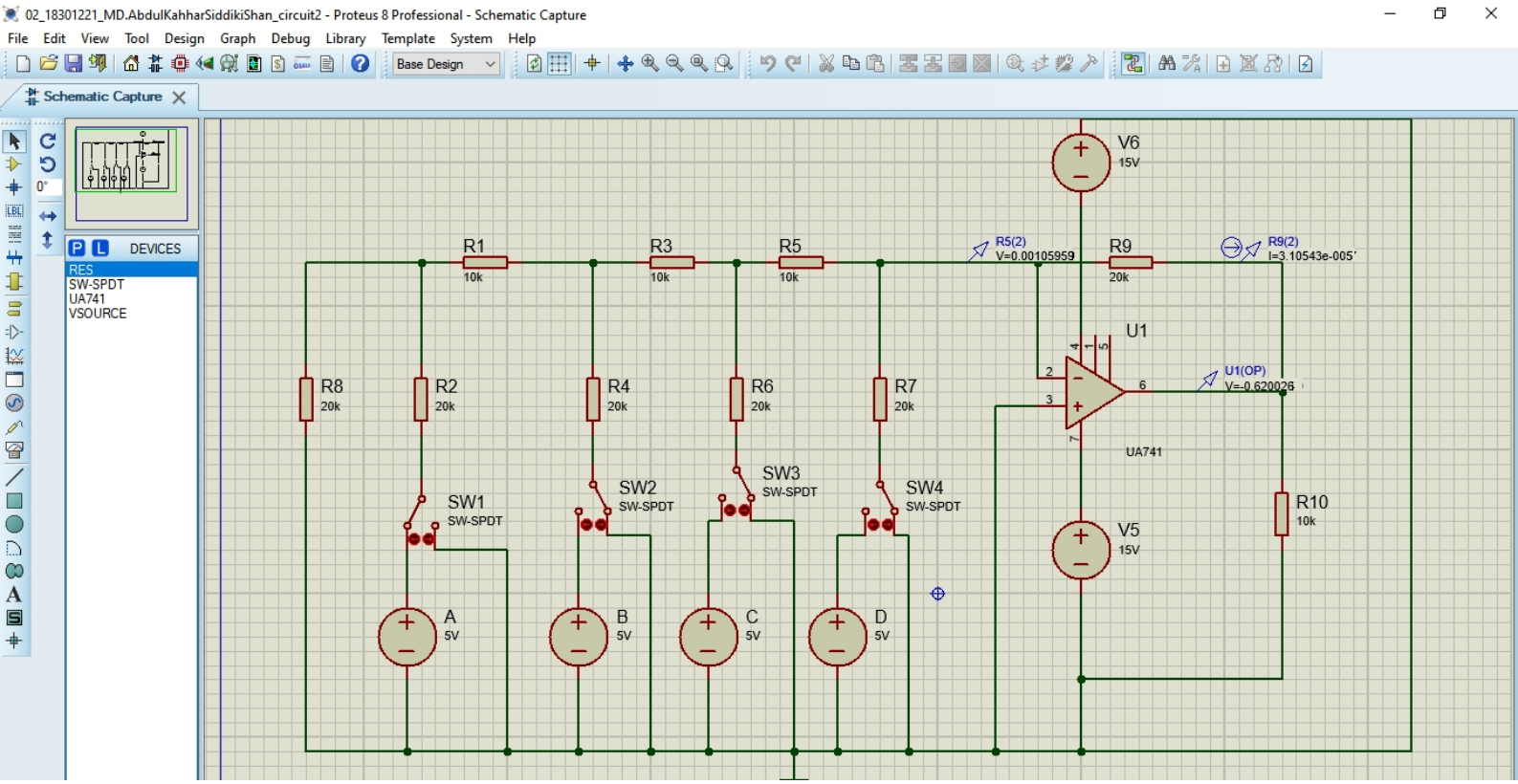
$V_A = 5V$, $V_B = V_C = V_D = 0$

$\therefore V_{out} = -\frac{5 \times 2}{1} \times \frac{1}{1}$

$V_{out} = -2\left(\frac{5}{16} + 0 + 0 + 0\right)$

$= -0.625\ V$

This value matches with Proteus value which I am providing below:


02_18301221_MD.AbdulKahharSiddikiShan_circuit2 - Proteus 8 Professional - Schematic Capture
File Edit View Tool Design Graph Debug Library Template System Help
Base Design
Schematic Capture
DEVICES
RES
SW-SPDT
UA741
VSOURCE
V6
15V
R1
10k
R3
10k
R5
10k
R5(2)
V=0.00105959
R9
20k
R9(2)
I=3.10543e-005
U1
U1(OP)
V=-0.620026
UA741
R8
20k
R2
20k
R4
20k
R6
20k
R7
20k
SW1
SW-SPDT
SW2
SW-SPDT
SW3
SW-SPDT
SW4
SW-SPDT
R10
10k
V5
15V
A
5V
B
5V
C
5V
D
5V

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4. What will be the analog output for the above circuit (you can either of D2A converter) if the high input voltage is the sum of last two digit of your students ID number and the low input is zero? Draw a table and fill up it for all possible combination

→ My ID = 18301221

Last two digit = 21 , Sum = 2 + 1 = 3V

Input Configuration	D	C	B	A	Output Voltage V_o(V)
1	0	0	0	0	0.002
2	0	0	0	3	-0.297
3	0	0	3	0	-0.59
4	0	0	3	3	-0.89
5	0	3	0	0	-1.19
6	0	3	0	3	-1.49
7	0	3	3	0	-1.79
8	0	3	3	3	-2.09716
9	3	0	0	0	-2.39
10	3	0	0	3	-2.69
11	3	0	3	0	-2.99
12	3	0	3	3	-3.29
13	3	3	0	0	-3.59
14	3	3	0	3	-3.89
15	3	3	3	0	-4.19
16	3	3	3	3	-4.49

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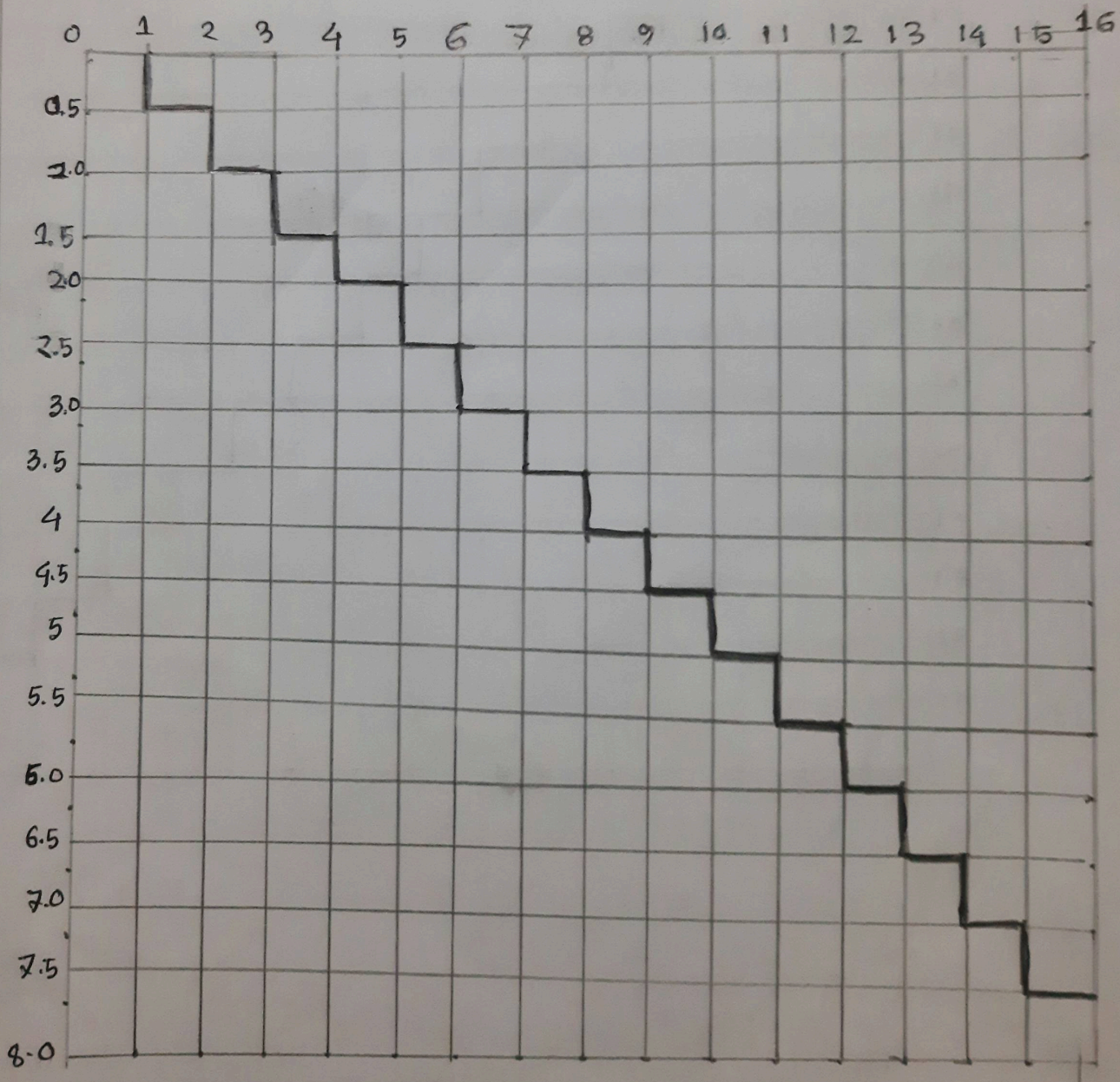
5. How does the step size varry with respect to RF (feedback register).

Here, current = $\frac{0 - V_o}{R_f}$

If the value of R_f increases, the V_o will increase. So, if R_f changes step size will change. [taking 0.49 as 0.5 0.99 as 1]

Graph for circuit-1



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Graph for circuit - 2