

1.

a) Regular expression: /123/g. Matches: 12.

b) Regular expression: /.*[0-9].*/g. Matches: 30.

c) Regular expression: /[aeiou]/g. Matches: 169.

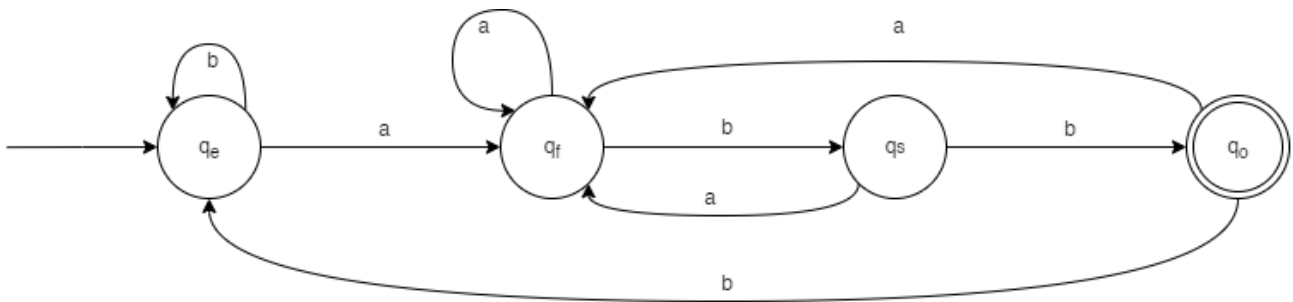
d) Regular expression: /[aeiou].[aeiou]/g. Matches: 23.

2.

a) $\Sigma = \{a, b, c\}$

	a	b	c
$\rightarrow q_0$	q_1	-	-
q_1	q_2	q_1	-
q_2	-	q_2	q_3
$*q_3$	-	-	-

b) $\Sigma = \{a, b\}$



3.

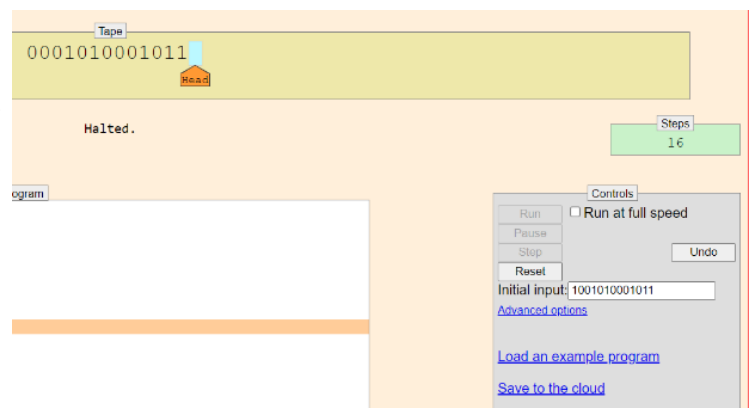
a)

0	-	-	L	0
0	0	1	L	1
0	1	0	L	1
1	0	1	L	1
1	1	0	L	1
1	-	-	R	2
2	0	0	R	2
2	1	1	R	2
2	-	-	*	HALT

i) 7 steps

ii) 9 steps

iii) 16 steps



b) The program does calculations based on the arithmetic sequence $a_n = 5 + (8n-8)$. The nearest value belonging to the sequence that has the same number of digits as the input will be returned.

4.

a) **b**1010**b** → **bb**1010**b** → **bbb**1010**b**

b0110**b** → **bb**0110**b** → **bbb**0110**b**

bbbbbb → **bbbbbbb** → **bbbbbbbb**

5.

The machine will halt at stage 4 without any additional message if the input satisfies the language requirement. Otherwise, the machine will halt at other stages and displays an error message.

0	X	X	R	0
0	-	-	*	4
0	a	X	R	1
0	b	X	R	2
1	a	a	R	1
1	X	X	R	1
1	b	X	L	3
2	b	b	R	2
2	X	X	R	2
2	a	X	L	3
3	X	X	L	3
3	a	a	L	3
3	-	-	R	0
4	-	-	*	HALT

Input aaabbbbaabb (satisfied requirement):

The screenshot shows a Turing machine simulator interface. At the top, a yellow tape contains 'XXXXXXXXXX' with a blue head at the first 'X'. Below the tape, the text 'Halted.' is displayed. On the left, a green box labeled 'Current state' shows 'HALT'. On the right, a green box labeled 'Steps' shows '80'. In the center, a table titled 'Turing machine program' lists 16 states and their transitions. The 'Initial input' field on the right contains 'aaabbbbaabb'. The 'Controls' panel on the right includes buttons for 'Run', 'Pause', 'Step', 'Reset', and 'Undo', along with a checkbox for 'Run at full speed' and links for 'Advanced options', 'Load an example program', and 'Save to the cloud'.

Input abbaabb (not satisfied requirement):

The screenshot shows the same Turing machine simulator interface. The yellow tape now contains 'XXXXXXX' with a blue head at the first 'X'. The text 'Halted. No rule for state '2' and symbol '-'.' is displayed. The 'Current state' box shows 'halt' and the 'Steps' box shows '32'. The 'Turing machine program' table is the same as in the previous screenshot. The 'Initial input' field contains 'abbaabb'. The 'Controls' panel is also the same.