1.

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

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

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

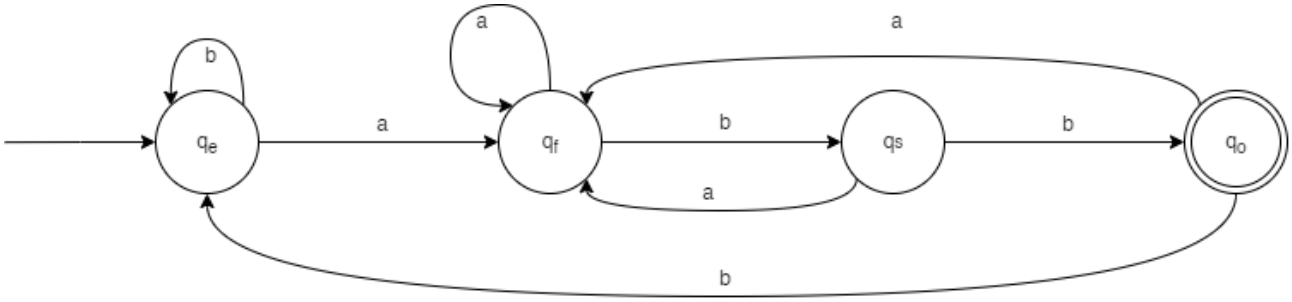
d) Regular expression:/[aeiou].[aeiou]/g. Matches: 23.

2.

a) ∑ = {a, b, c}

	a	b	c
→q_0	q_1	-	-
q_1	q_2	q_1	-
q_2	-	q_2	q_3
*q_3	-	-	-

b) ∑ = {a, b}



3.

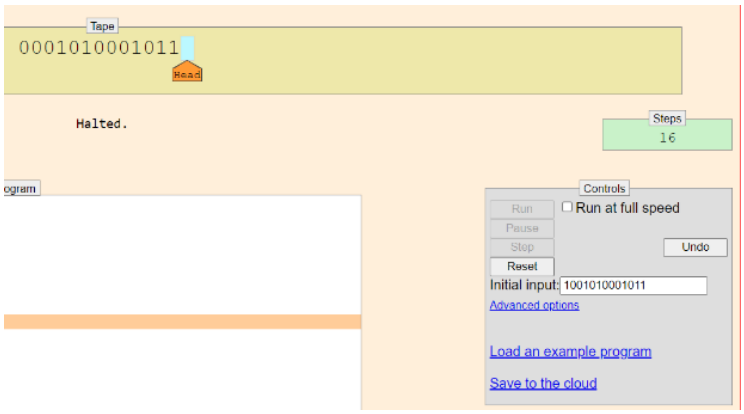
a)

```
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**1010b → **bb**1010b → b**b**1010b

b0110b → **bb**0110b → b**b**0110b

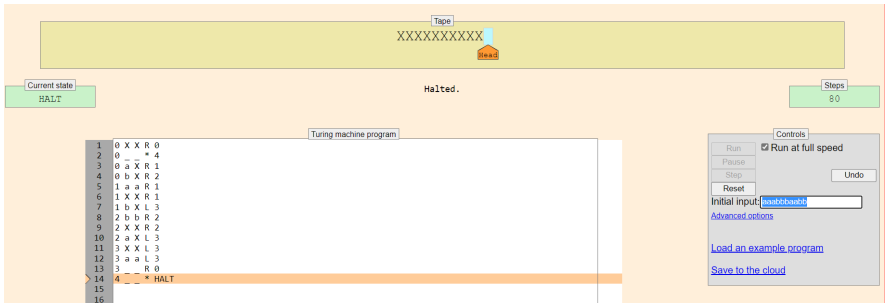
bbbbbb → **bb**bbbbb → b**b**bbbbb

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 aaabbbaabb (satisfied requirement):



Input abbaabb (not satisfied requirement):