

## Exercises01

**# halt on the leftmost digit.**

input: '101101'

blank: ' '

start state: right

table:

# scan to the rightmost digit

right:

[1,0]: R

' ' : {L: carry}

# then carry the 1

carry:

1 : {write: 0, L}

[0, ' ']: {write: 1, L: left}

left:

[1,0]: L

' ' : {R: done}

done:

**# adds 2 to a binary number.**

input: '1000'

blank: ' '

start state: right

table:

# scan to the rightmost digit

right:

[1,0]: R

' ' : {L: lastdigit}

lastdigit:

[1,0]: {L : carry}

carry:

1 : {write: 0, L}

[0, ' ']: {write: 1, L: haltleft}

haltleft:

[1,0]: L

' ' : {R: done}

done:

**# subtract 1.**

input: '1001'

blank: ' '

start state: right

table:

# scan to the rightmost digit

right:

[1,0]: R

' ' : {L: carry}

carry:

0 : {write: 1, L}

[1, ' ']: {write: 0, L: left}

left:

[1,0]: L

' ' : {R: sub}

sub:

' ' : R

1 : {R: done}

0 : {write: ' ', R: done}

done:

## Exercises02: : Divisible by 3

**# Modify the machine to check if n-1 is divisible by 3**

start state: q0

table:

q0:

0: R #  $2*0 + 0 = 0$

1: {R: q1} #  $2*0 + 1 = 1$

q1:

0: {R: q2} #  $2*1 + 0 = 2$

1: {R: q0} #  $2*1 + 1 = 3$

' ' : {R: accept}

q2:

0: {R: q1} #  $2*2 + 0 = 4$

1: {R: q2} #  $2*2 + 1 = 5$

accept:

**# Round the number up to the nearest multiple of 3.**

start state: q0

table:

q0:

0: R #  $2*0 + 0 = 0$

1: {R: q1} #  $2*0 + 1 = 1$

q1:

0: {R: q2} #  $2*1 + 0 = 2$

1: {R: q0} #  $2*1 + 1 = 3$

' ' : {L: add2}

q2:

0: {R: q1} #  $2*2 + 0 = 4$

1: {R: q2} #  $2*2 + 1 = 5$

' ' : {L: add1}

add1:

1 : {write: 0, L}

```

    [0, ' ']: {write: 1, L: done}
add2:
    [1,0]: {L : carry}
carry:
    1      : {write: 0, L}
    [0, ' ']: {write: 1, L: done}
done:

```

### # Round the number down to the nearest multiple of 3.

start state: q0

table:

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q0:
    0: R      #  $2*0 + 0 = 0$ 
    1: {R: q1} #  $2*0 + 1 = 1$ 

```

```

q1:
    0: {R: q2} #  $2*1 + 0 = 2$ 
    1: {R: q0} #  $2*1 + 1 = 3$ 
    ' ': {L: sub1}

```

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q2:
    0: {R: q1} #  $2*2 + 0 = 4$ 
    1: {R: q2} #  $2*2 + 1 = 5$ 
    ' ': {L: sub2}

```

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sub1:
    0      : {write: 1, L}
    [1, ' ']: {write: 0 , L: left}

```

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left:
    [1,0]: L
    ' ' : {R: sub}

```

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sub:
    ' ' : R
    1 : {R: done}
    0 : {write: ' ', R: done}

```

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sub2:
    [1,0]: {L: sub1}
done:

```