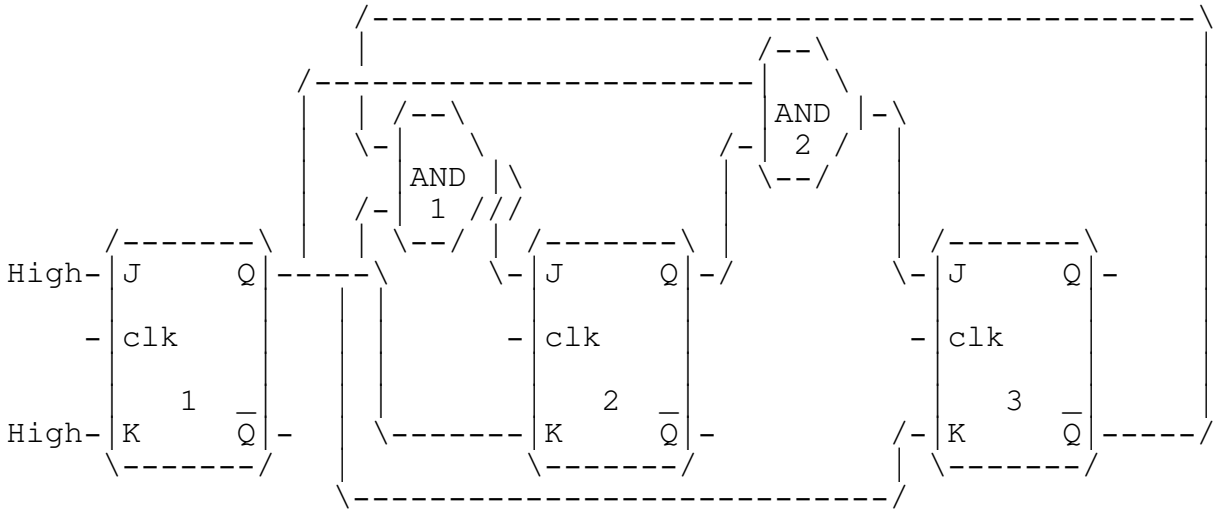
Logic Simulator Example 4 : A Divide by 6 counter

In the fourth example we are going to wire-up a divide-by-6 counter from three J-K flip flops and two 2-input AND gates. We will use three lamps connected to the Q-outputs of the flip flops to indicate the current count of the counter.



The clock pulse is used to provide the input to be divided. For clarity, the clock connections are not shown but must be 'wired' to the clock output on the board.

The devices have been numbered in preparation for the simulation. Each type of device is separately numbered starting from 1.

Enter the logic board simulator by typing

    LOGIC

Use the E key to enter the connections as follows:

```
J-K flip flop number 1, J-input  to  High
J-K flip flop number 1, K-input  to  High
J-K flip flop number 2, J-input  to  2-input AND   number 1
J-K flip flop number 2, K-input  to  J-K flip flop number 1, q-output
J-K flip flop number 3, J-input  to  2-input AND   number 2
J-K flip flop number 3, K-input  to  J-K flip flop number 1, q-output
J-K flip flop number 1, C-input  to  Clock
J-K flip flop number 2, C-input  to  Clock
J-K flip flop number 3, C-input  to  Clock
2-input AND   number 1, input-1  to  J-K flip flop number 3, qbar-output
2-input AND   number 1, input-2  to  J-K flip flop number 1, q-output
2-input AND   number 2, input-1  to  J-K flip flop number 1, q-output
2-input AND   number 2, input-2  to  J-K flip flop number 2, q-output
Lamp number 1,  to  J-K flip flop number 1, q-output
Lamp number 2,  to  J-K flip flop number 2, q-output
Lamp number 3,  to  J-K flip flop number 3, q-output

Press the ESC key to get out from the editing screen.
The connections have been made to give a divide by 6 counter.
```

As we saw in the J-K flip flop example earlier, pressing the C key acts as a 'clock' pulse, and this should increase the count of the counter by one. Verify this for yourself, viewing the count lamps 1 to 3 (with the lamps giving the binary value of the count).

Pressing C more, or keeping C pressed should move the counter, and therefore the lamps 1 to 3, through the binary count 0 to 5 and back to 0.

Show the devices on the screen (using the V and C keys):

```
BOX 2  with  2-input AND gate number 1
BOX 3  with  2-input AND gate number 2
BOX 5  with  J-K flip flop    number 1
BOX 6  with  J-K flip flop    number 2
BOX 7  with  J-K flip flop    number 3
```

Now repeatedly pressing the C key and you show the input and output values of the devices changing.

The outputs from the counter are currently indicated in binary on the lamps. We can see the count in decimal by attaching a binary-to-decimal decoder (or decoder for short). The decode inputs have the following values:

```
    input-1  has value 1
    input-2  has value 2
    input-3  has value 4
    input-4  has value 8
```

This means that the inputs have the value of '2 raised to the power of the input number'. The output is shown as a decimal number on the viewed diagram.

To connect a decoder to the counter, press E and connect:

```
  Decoder number 1, input-1  to J-K flip flop number 1, q-output
  Decoder number 1, input-2  to J-K flip flop number 2, q-output
  Decoder number 1, input-3  to J-K flip flop number 3, q-output
```

After pressing ESC, view the decoder in box 8 by pressing V then C and filling

```
  BOX 8   with   Decoder number 1
```

Pressing C should alter the decimal output of the decoder.

Save the circuit to disk by pressing S and typing the filename:

```
    DIVBY6.LOG
```

To finish the session on the simulator press the Q key.

→→→→→→→→→→→→→→→→→→→→→→→→→→→→→→→→