INDRAPRASTHA INSTITUTE *of*
INFORMATION TECHNOLOGY
DELHI

Department
of
Electronics & Communication Engineering

ECE111|Digital Circuits
Section: B

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Lab_9:

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Part A

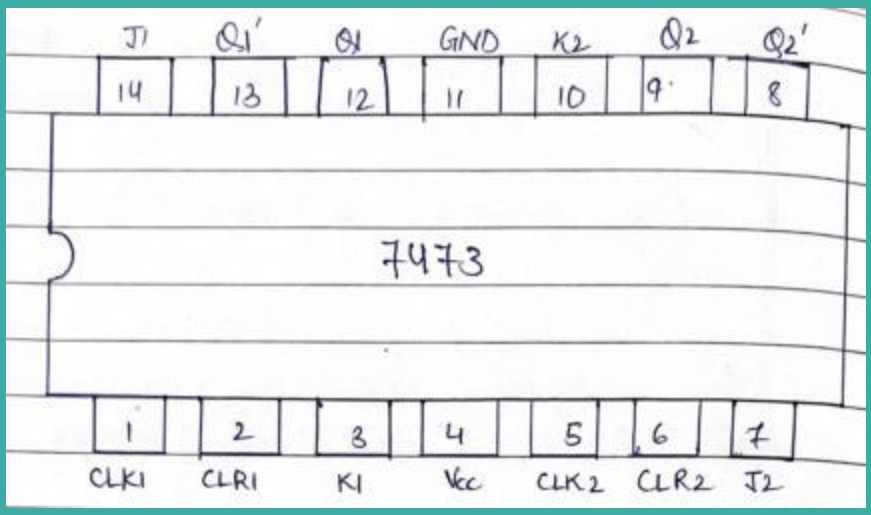
Aim: To create a UP and DOWN counter with JK Flip Flop

Components/ICs Used: Breadboard, wires, LEDs, resistors, slide switches, power supply, JK Flip Flop, function generator

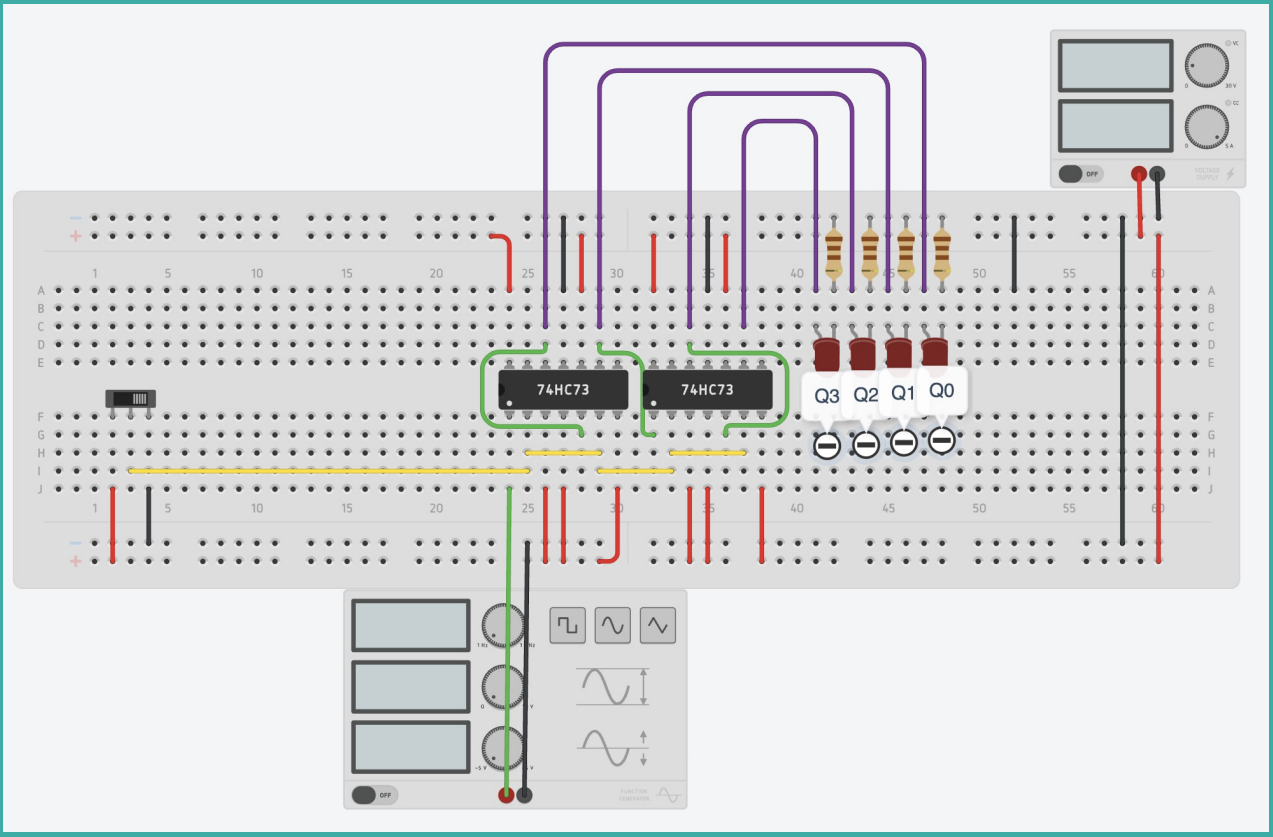
Link of TINKERCAD Workspace:
UP Counter
https://www.tinkercad.com/things/lgk4XaMXvWu-tremendous-stantia-migelo/editel?sharecode=66fNR6caJ8rkcT-BJaGSME2M6duCZD4cEEfvqjj6pCE

DOWN Counter
https://www.tinkercad.com/things/1A2JEMTAeDB-copy-of-parta-up/editel?sharecode=SPevZjApHsbldjxhXXKGpvMRvBOesqb3xyZbsgD548w

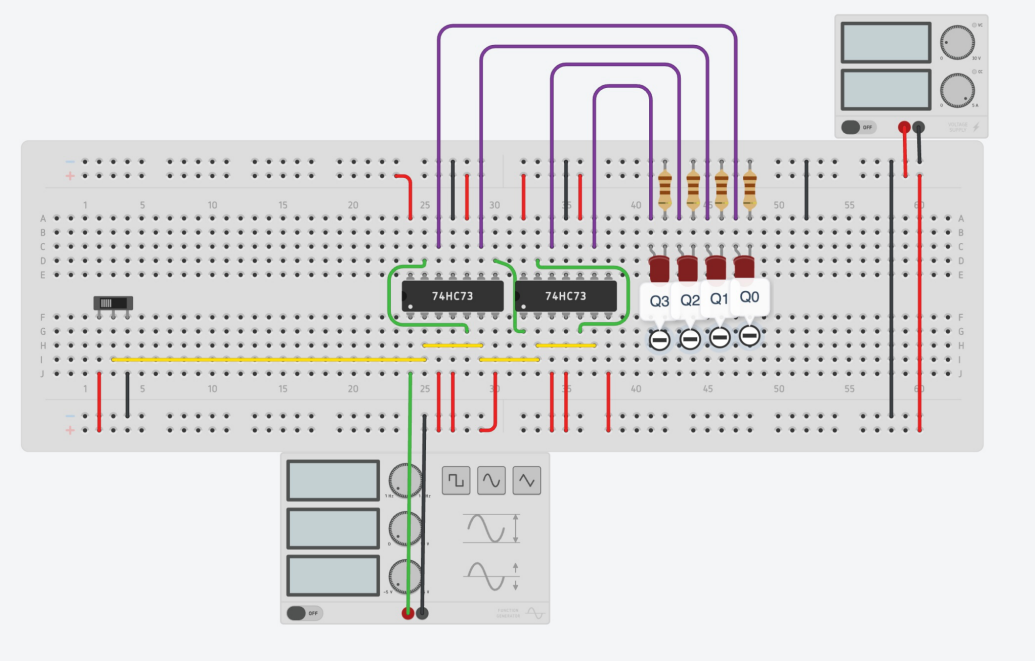
Pin Diagram of the IC:



Circuit Diagram:
UP Counter

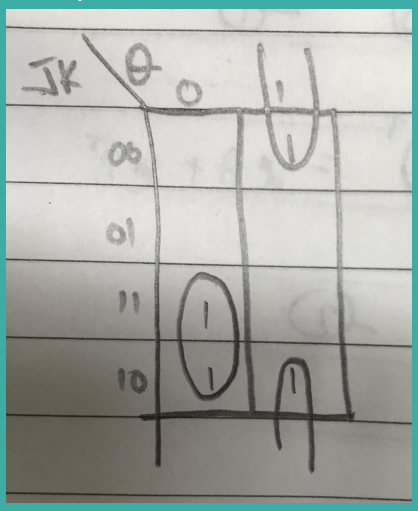


DOWN Counter

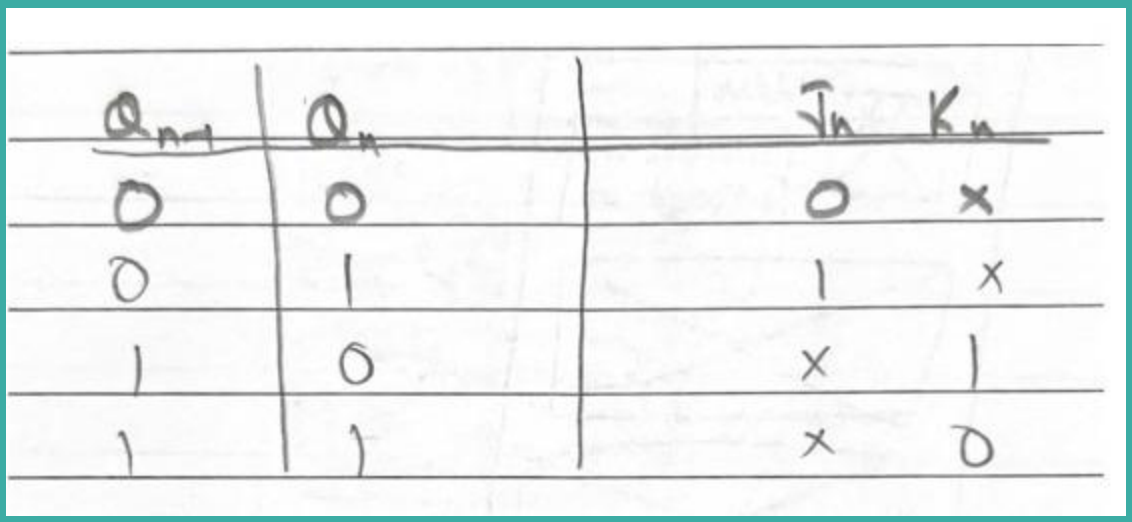


Characteristic equation:
$Q_n = JQ_{n-1}' + K'Q_{n-1}$

K maps:



Excitation table:



Observations/Results: A UP and DOWN binary counter is seen

- When CK1=Q0, CK2=Q1, CK3=Q2:
  A binary UP counter is observed in which the value of $Q_3Q_2Q_1Q_0$ is observed to be 0000, 0001, 0010, …, 1111
- When CK1=Q0', CK2=Q1', CK3=Q2':
  A binary DOWN counter is observed in which the value of $Q_3Q_2Q_1Q_0$ is observed to be 1111, 1110, 1101, …, 0000

Application:

- It is used to count the number of pulses inputted in the first clock by the function generator
- They can also be used as a binary clock

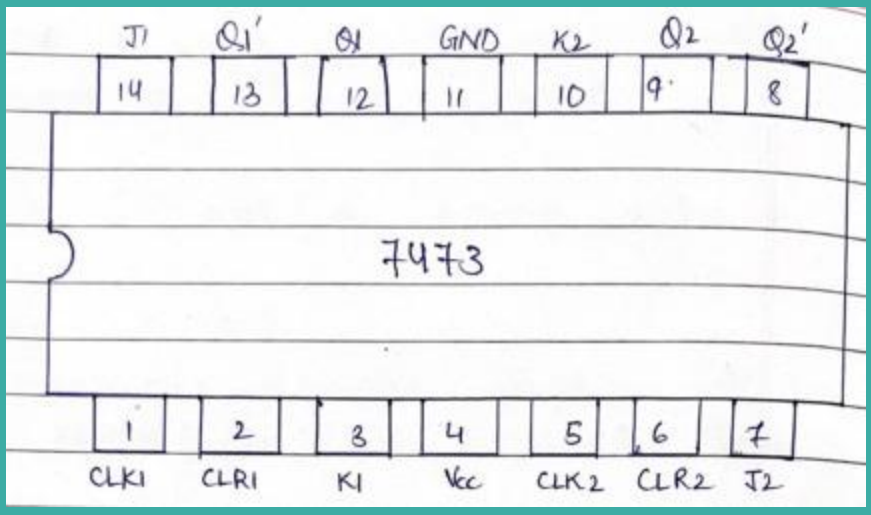
Part B

Aim: To create a decade ripple counter

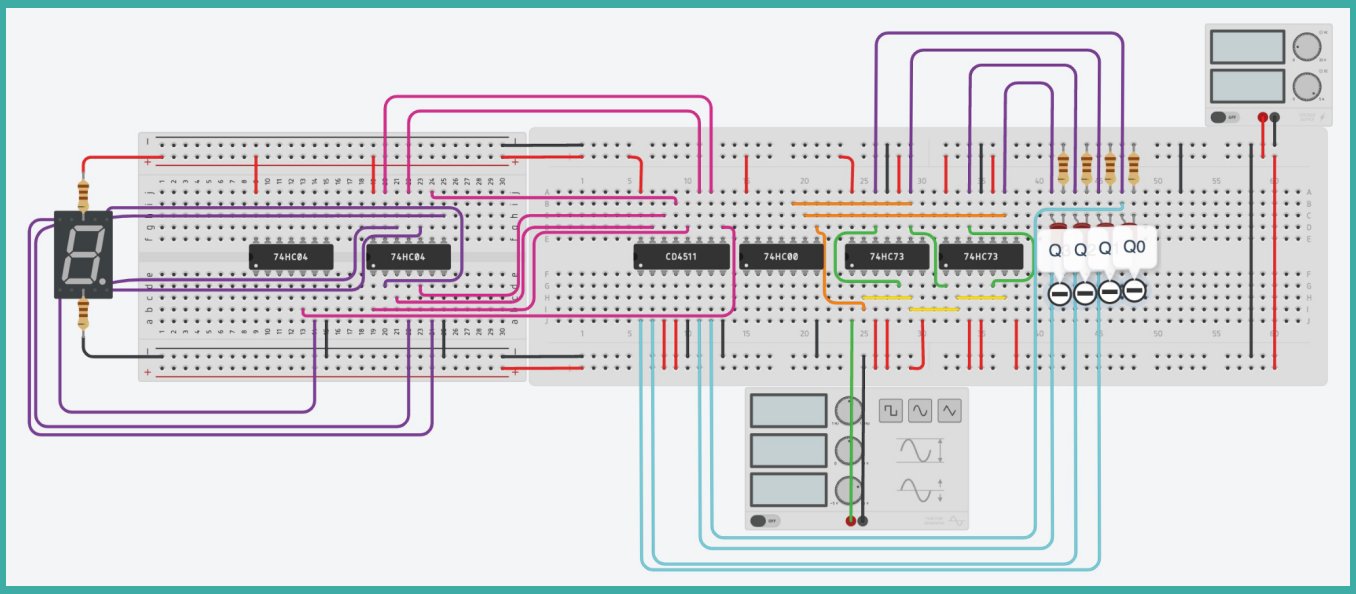
Components/ICs Used: Breadboard, wires, LEDs, resistors, slide switches, power supply, function generator, JK Flip Flop, NAND gate, 7 segment decoder, 7 segment display

Link of TINKERCAD Workspace:
https://www.tinkercad.com/things/kx1BoP9xEO5-copy-of-lab09-partb/editel?sharecode=b5l3nGmChL4u8blvxBmrawepHyXRkH-7RMKEqZDrqTc

Pin Diagram of the IC:

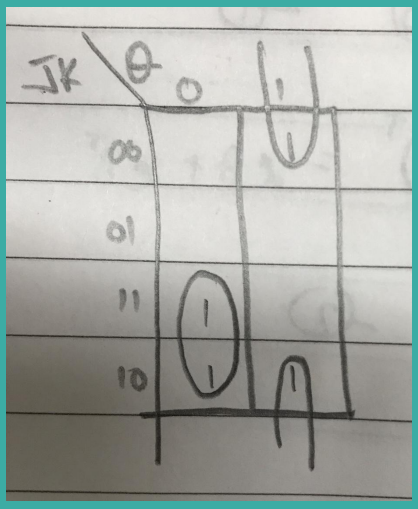


Circuit Diagram:

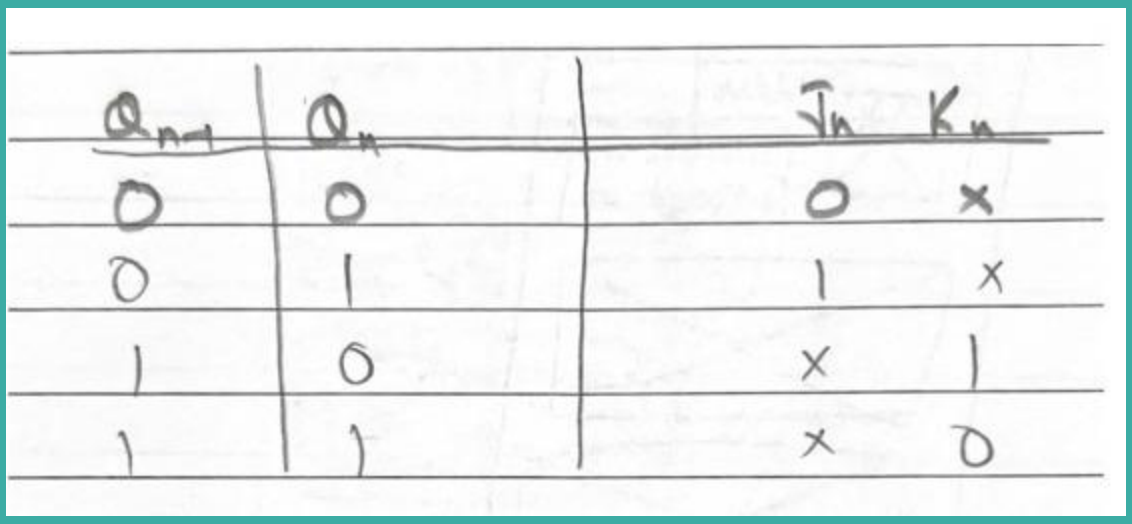


Characteristic equation:
$Q_n = JQ_{n-1}' + K'Q_{n-1}$

K maps:



Excitation table:



Observations/Results:
A binary UP counter is observed in which the value of $Q_3Q_2Q_1Q_0$ is observed to be 0000, 0001, 0010, …, 1001 which is then decoded to decimal form and is shown via a 7 segment display

Application:

- It is used to count the number of pulses inputted in the first clock by the function generator
- They can also be used as a binary clock