Electronics Circuits – Project 01

Building a simple decimal counter with 7 segments display

#	Student ID	Student Name	Grade (10)
1			
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Delivery Date	

١. يتم تسليم المشروع في خلال أسبوعين من تاريخ عرضة، و يتم حذف درجتان و نصف من المشروع عن كل أسبوع تأخير
٢. يتم تسليم المشروع للمهندس معيد المقرر مباشرة

Objective

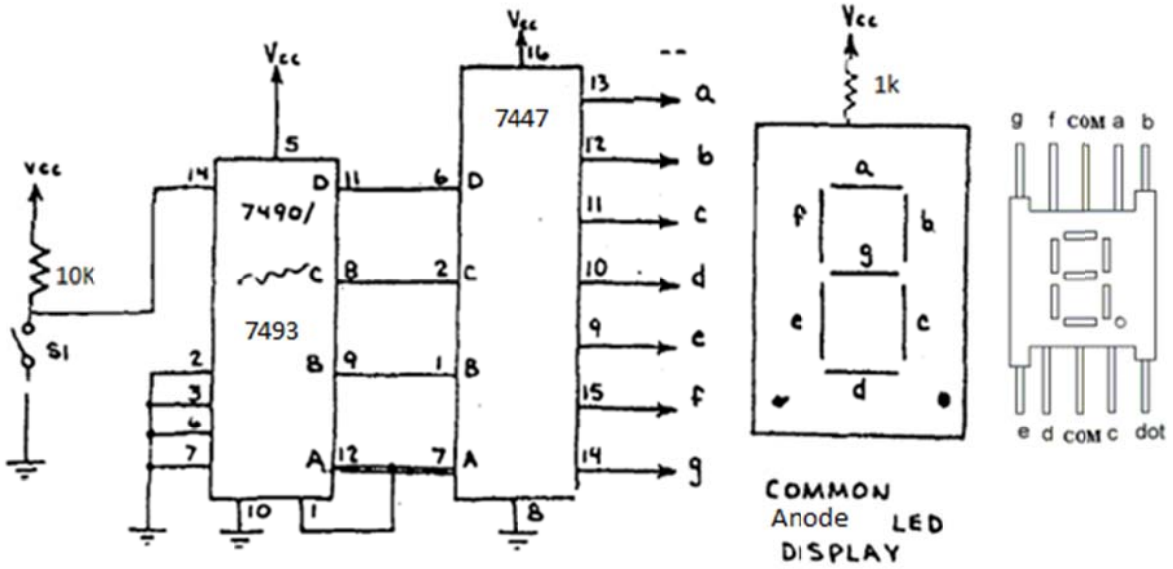
To build a functional prototype of decimal counter that displays its counts on 7-segments display

Theory

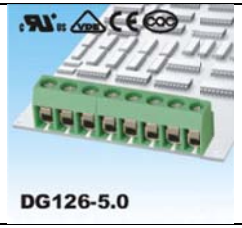
Circuits consists of four different stages

1. Power source (3x1.5 volt batteries , led , R=1Kohm)
   Power source, supply the whole circuit with the required power to operate
2. Pulse generator (press , R=10K)
   Pulse generator, like a home switch, it sends a pulses to counter which presents the event that trigger the counter
3. Decimal counter IC (7490)
   Decimal counter, is a chip counts from 0 to 9 up on receiving a trigger. Counter output its count on 4 pins presents the binary re-presentation of decimal numbers.
4. 7-segments display & decoder (common cathode 7 segments, 7448 IC, resistors 2x1 Kohm).
   7-segments, a 7 interconnected leds that presents the decimal number.
   7-segments decoder is a chip that converts the counter binary numbers to a corresponding decimal symbol on 7-segments chip.

Schematic



Components list

#	item	link	image
1	3 x AAA Battery Holder + On/Off Switch	http://ram-e-shop.com/oscmax/catalog/product_info.php?cPath=72_75&products_id=1195	
2	Panasonic 1.5V AA-Size Battery (Pack of 4)	http://ram-e-shop.com/oscmax/catalog/product_info.php?cPath=72_75&products_id=708	
3	2 Pin PCB Screw Terminals Block	http://ram-e-shop.com/oscmax/catalog/product_info.php?products_id=752	

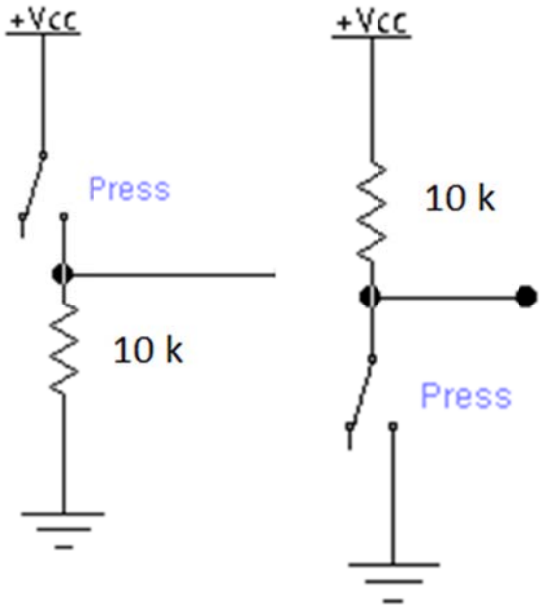
4	Bread Board 630-Tie Point "BB-01"	http://ram-e-shop.com/oscmax/catalog/product_info.php?products_id=164	
5	Connecting Jumper Wires for Bread Board & Arduino (65 Wire) 22AW	http://ram-e-shop.com/oscmax/catalog/product_info.php?products_id=3183	
6	Press 2pin	http://ram-e-shop.com/oscmax/catalog/product_info.php?products_id=1568	

7	10 x 1 K resistor	http://ram-e-shop.com/oscmax/catalog/product_info.php?cPath=31_46_69&products_id=342	
8	10 x 10K resistor	http://ram-e-shop.com/oscmax/catalog/product_info.php?cPath=31_46_69&products_id=362	
9	4 x led	http://ram-e-shop.com/oscmax/catalog/product_info.php?cPath=60&products_id=228	
10	7493	http://ram-e-shop.com/oscmax/catalog/product_info.php?cPath=21_45&products_id=97	
11	7447	http://ram-e-shop.com/oscmax/catalog/product_info.php?cPath=21_45&products_id=91	
12	Common Anode 7-segments display	http://ram-e-shop.com/oscmax/catalog/product_info.php?cPath=152&products_id=1068	

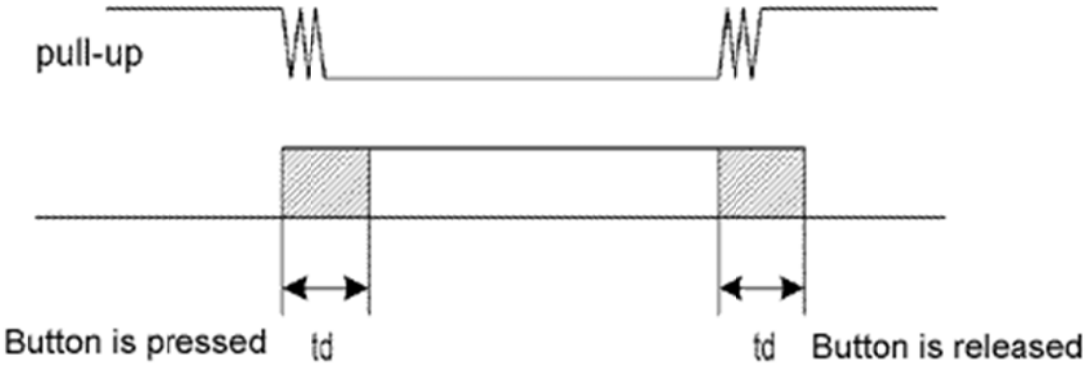
Components interconnection

Plus generator

- Buttons that are used here are also called “press-buttons".
- A pull-up resistor is needed to avoid producing short circuit between Vcc, and Gnd
- There are two possible connections as shown
  - Active high
  - Active low

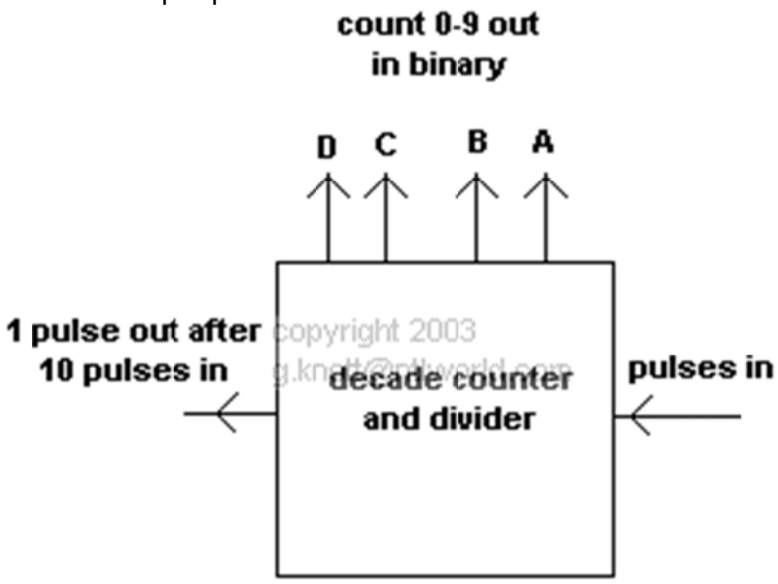


- There is a short time period when vibration (oscillation) can occur as a result of unevenness of mechanical contacts, or as a result of the different speed in pushing a button (this depends on person who pushes the button).

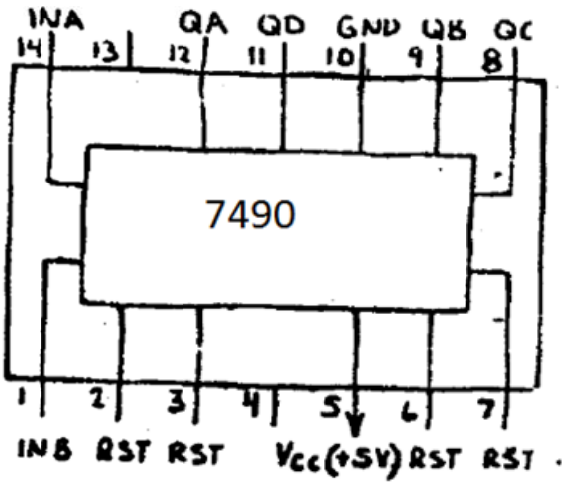


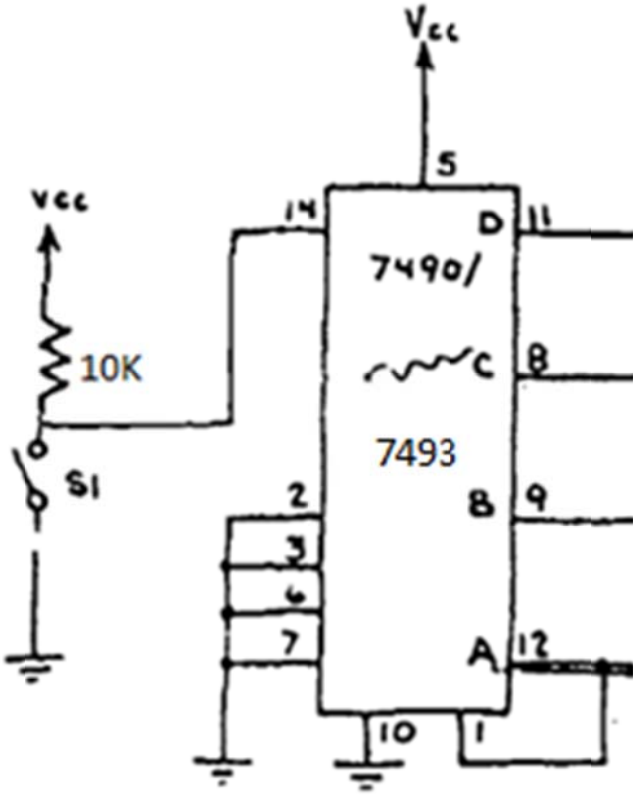
Decimal counter IC (7490/7493)

The 7490 integrated circuit counts the number of pulses arriving at its input.
The number of pulses counted (up to 9) appears in binary form on four pins of the ic.
When the tenth pulse arrives at the input, the binary output is reset to zero (0000) and a single pulse appears at another output pin.



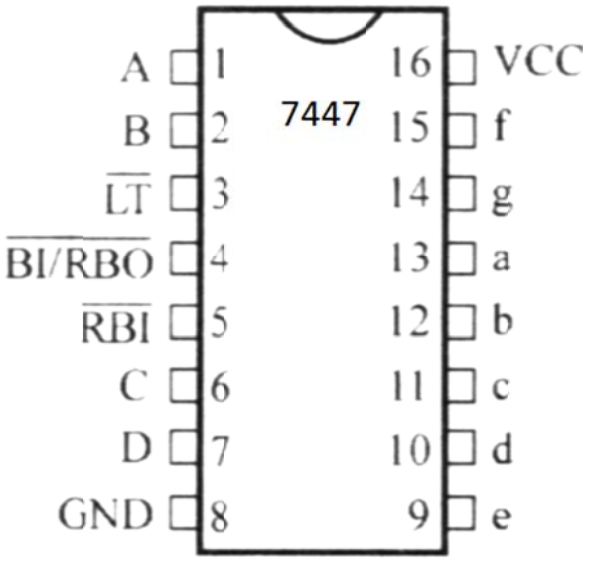
decimal	binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

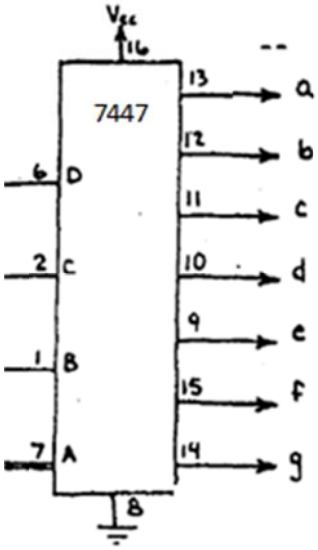

INA
QA
QD
GND
QB
QC
14
13
12
11
10
9
8
7490
1
2
3
4
5
6
7
INB
RST
RST
Vcc(+5V)
RST
RST


Vcc
5
Vcc
14
D
11
7490/
C
B
10K
7493
S1
2
B
9
3
6
7
A
12
10
1

7-segments decoder (7447)

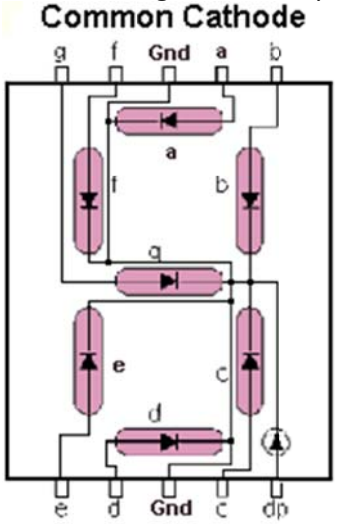
This package accepts a 1-2-4-8 positive-logic Binary Coded Decimal (BCD) input and converts it to the proper pattern necessary to illuminate a 7 segment display.
A high output is intended to light the segment. (Common cathode), meaning the negative connection of all of the LEDs is tied together.





7-segments display

seven segment display, consists of seven LEDs arranged in a rectangular fashion as shown. Each of the seven LEDs is called a segment because when illuminated the segment forms part of a numerical digit (both Decimal and Hex) to be displayed. An additional 8th LED is sometimes used within the same package thus allowing the indication of a decimal point, (DP) when two or more 7-segment displays are connected together to display numbers greater than ten.



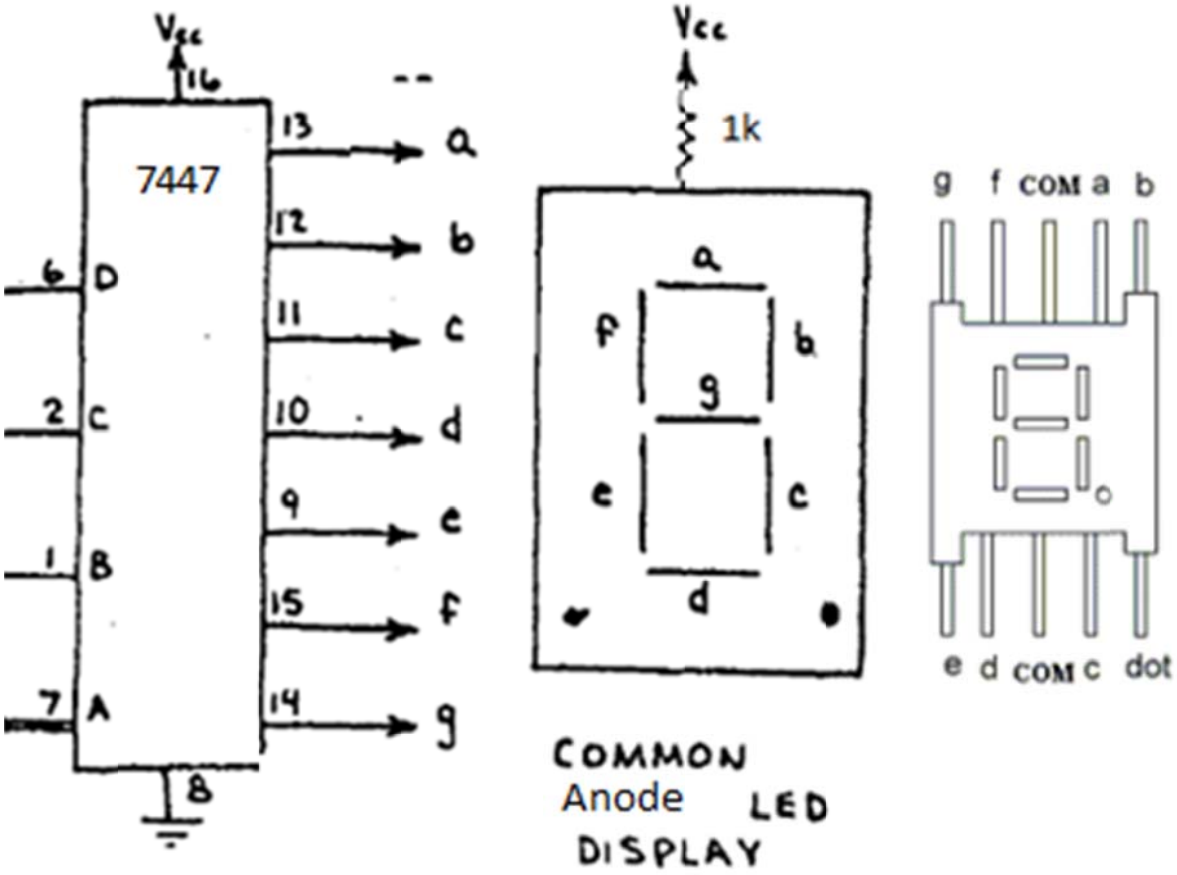
Each one of the seven LEDs in the display is given a positional segment with one of its connection pins being brought straight out of the rectangular plastic package. These individually LED pins are labelled from a through to g representing each individual LED. The other LED pins are connected together and wired to form a common pin.

symbol	h	g	f	e	d	c	b	a	7segment
0									
1									
2									

symbol	h	g	f	e	d	c	b	a	7segment
3									
4									
5									

symbol	h	g	f	e	d	c	b	a	7segment
6									
7									
8									

symbol	h	g	f	e	d	c	b	a	7segment
9									


Vcc
16
7447
13
12
11
10
9
15
14
8
6
D
2
C
1
B
7
A
a
b
c
d
e
f
g
Vcc
1k
a
f
b
g
e
c
d
COMMON
Anode LED
DISPLAY
g f COM a b
e d COM c dot