ET1011: INTRODUCTION TO ENGINEERING

ET1013: INTRODUCTION TO ENGINEERING I

Name:

Admin No:

Class:

General Laboratory Safety Rules and Regulations

1. Wear appropriate attire for the lab/workshop:
   - Footwear (e.g. slipper and sandal) that exposes the feet is not permitted.
   - Do not wear loose clothing, bangles, bracelets, necklaces, etc. that may cause entanglement with rotating/moving part of a machine.
   - Use Personal Protective Equipment like goggle when performs drilling job.
2. Use the right tool for the right job.
3. Always keep the lab/workshop clean and tidy.
4. Know where the following items are located:
   - Fire-Extinguisher
   - First-Aid Box
   - Emergency Exit
   - Emergency Switch (if provided)
5. Ensure all connections are connected properly and correctly before switching on the power source.
6. Do not operate electrical equipment in the following situations:
   - Damaged housing and frayed or damaged power cords.
   - Standing on damp or metal floor.
   - Faulty equipment.
   - Equipment not properly grounded.
   - Not feeling well.
7. Observe and follow all the safety instructions, rules and regulations of the lab/workshop.
8. Do not use the soldering iron with damaged or worn-out power cord.
   - Turn on ventilating fans while performing soldering to extract the poisonous fume.
   - Never touch the soldering iron that is turned on.
   - Always wash your hands with soap and water after handling solder as the lead is poisonous and bad for health.
   - Do your soldering on a heat-resistant mat
   - Never leave your soldering iron on and unattended.
   - Rest your hot soldering iron in the soldering stand.
   - Switch off the soldering iron when not in use.
   - Switch off the soldering iron 15 minutes before the end of the lesson (before tidy-up the work bench)
   - Make sure that your soldering iron is properly earthed.
9. The leads/wires should face downwards when trimming and this is to prevent the leads/wires fly off and cut the eyes or body parts.
10. Report all near accidents or incidents to the Laboratory In-charge.
11. When in doubt, ASK.

Discovering Engineering

Engineering is the science of designing and creating. Reverse engineering is the science of taking things apart to see how they work. Have you ever wondered what makes devices work or what is inside them? Let's have some discovering engineering fun on some home appliances like bread toaster, hair dryer, steam iron, fan, water heater, fluorescent lamp fitting and toaster oven.

Though there is an unlimited variety of home appliances, nearly all are constructed from the following basic types of parts.

- Appliance cord - wire and plug.
- Internal wiring - cables and connectors.
- Electrical overload protection devices - fuses and circuit breakers.
- Thermal protection devices - thermal fuses and thermal switches.
- Appliance controls - switches, thermostats, rheostats, and timing mechanisms.
- Interlocks - prevent operation with case or door open.
- Light bulbs - incandescent and fluorescent.
- Indicators - incandescent or neon light bulbs or LEDs.
- Heating elements - Nichrome coils or ribbon, Calrod, Quartz.
- Solenoids - small and large.
- Small electronic components - resistors, capacitors, diodes.
- Motors - universal, induction, DC, timing.
- Fans and Blowers - bladed or centrifugal.
- Electronic controllers - simple delay or microprocessor based.

Before taking the appliance apart…

What electrical appliance is being taken apart?

____

Illustrate the electrical appliance in your report with all parts labelled in details.

What does the electrical appliance do when in operation?

____

____

How are you going to take it apart? What tools do you need?

____

____

What kind of parts do you think you will find inside?

____

____

Inside the appliance

Illustrate with diagrams to explain, as clearly as you can, the functions of the different parts of the appliance and how these essential parts work together to achieve the intended purpose. You may wish to pay attention to the following points:

- Where the power cord enters the appliance, where do the different cables (Live, Neutral & Earth) terminate? How are they terminated?
- If there is an Earth wire, where is it attached to? To a plastic part or a metal part?
- Electrical safety is of paramount importance if an appliance is to be awarded a safety mark. Locate where the protective device is and how it is connected to the incoming cables. Is a particular component a resistor, a switch or something else?
- Once a device is identified, can you tell what function it plays in the appliance?
- Does any of the inside parts surprise you?

Research

Q. The appliance cord delivers electricity to the appliance and it is typically constructed of two or three wires and a plug with 2 or 3 prongs. Open the cover and sketch the internal wiring of a 3-pin plug.

Q. Illustrate what happens if the Live wire and Earth wire connections are swapped.

Q. Explain, with illustrations, why the fuse and switch must be on Live wire.

Q. What is double insulation? Is your home appliance double-insulated? How do you tell if the appliance is 'double insulated'?

Q. Why high power appliances need thicker cables?

Q Is it true that the thickness of the insulation of a wire or cable a reliable indication of its capacity or voltage rating? Why?

Q. Fuses and circuit breakers are electrical overload protection devices used to protect the equipment from short circuit or severe overload resulting from a failed component or improper use. Illustrate with diagrams to explain why circuit breaker does the same job as the fuse but works in a different way.

LEARN HOW TO MAKE CIRCUITS ON A STRIPBOARD IN LESS THAN 5 WEEKS!

(Activity Book)

Documenting and reflecting your learning journey

Session 1: Creating Your First Stripboard

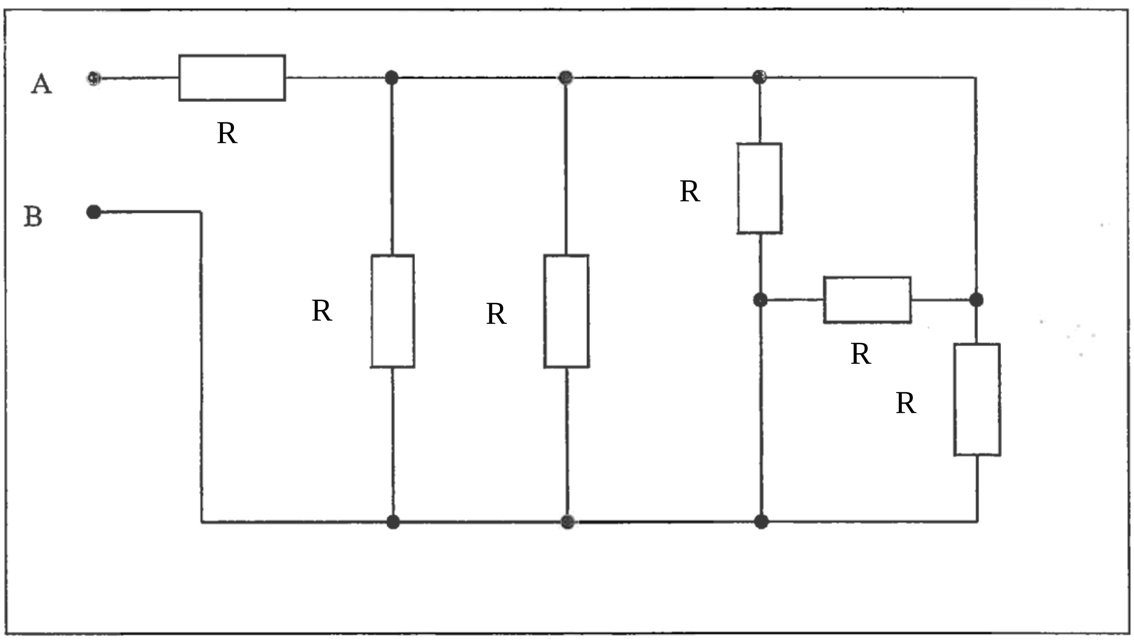
Difficulty Level: ★☆☆☆☆

Estimated Duration: ~ 2.5 hours

It is important that you learn the skills/techniques on how to use the relevant tools while creating your first Stripboard. Thus, be sure go through the steps mindfully.

At the end of the module, you should be able to identify the key resources to help you get started in a similar project and be successful and confident in applying the skills and techniques learnt in the work to produce your own 7-segment display board and logic board!

Step 1: Create/Find a schematic diagram



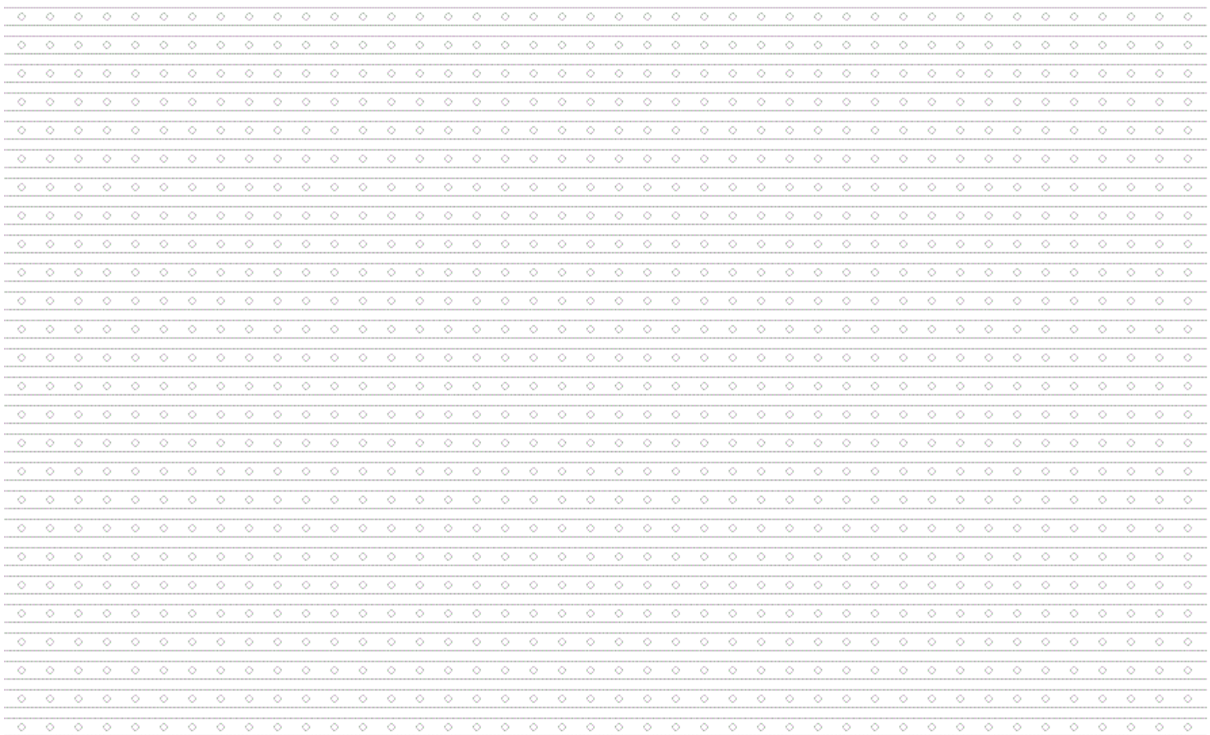
Step 2: Understand the Schematic Diagram

Determine the values of R1, R2, R3, R4, R5 and R6 using colour code.
Calculate the theoretical values of the total resistance across AB.

Total resistance across AB using DMM: _______________Ω

Step 3: Assemble components and obtain their physical layout/Pin configurations

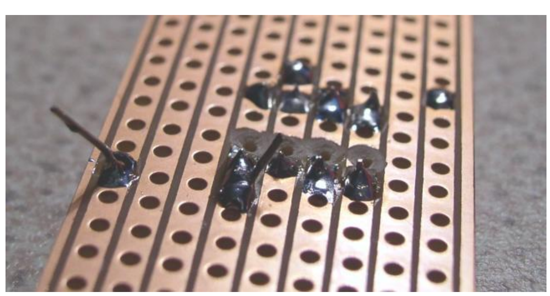
Step 4: Plan your Components' Layout



Step 5: Solder the components

Step 6: Complete the Remaining Connections using Wires (if any)

Step 7: Break the copper track according to your layout plan



Step 8: Eight Perform Visual Inspection and Continuity Test

Always do a visual inspection to check for any mistakes in your connections and soldering problems.

Learn to use DMM to check for any open or short circuit connections.

Step 9: Test and check if your Stripboard work

Did you get a reading across AB that is close to what you expected in step 2?

Step 10: Check and troubleshoot if necessary

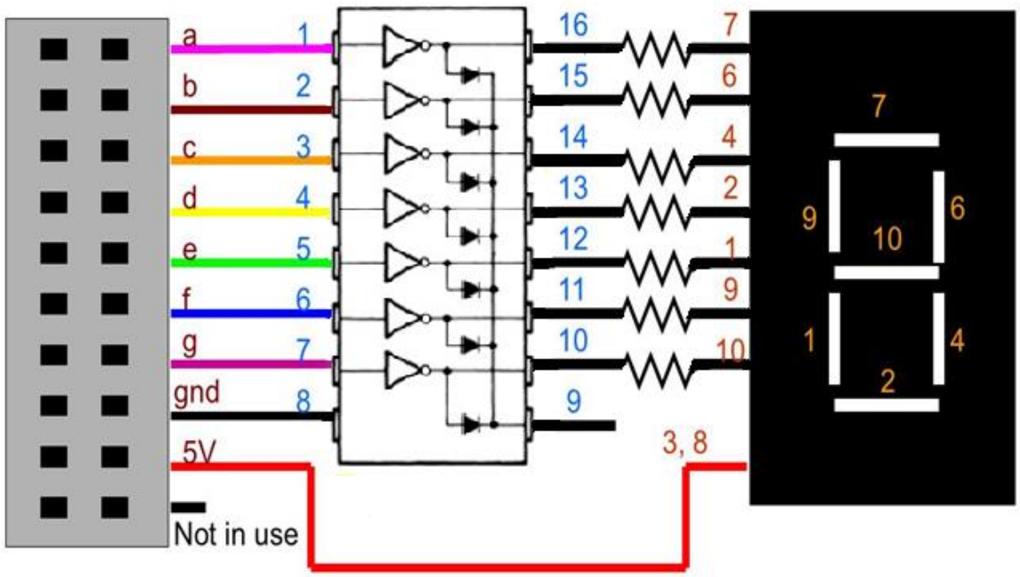
Session 2: Creating Your Own 7 Segment Display Board

Difficulty Level: ★★☆☆☆

Estimated Duration: _____ hours

Submission date: _______________

<u>Step 1:</u> Create/Find a schematic diagram



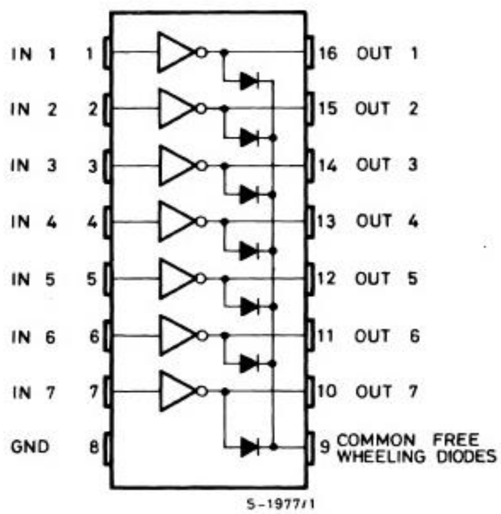
<u>Step 2:</u> Understand the schematic diagram

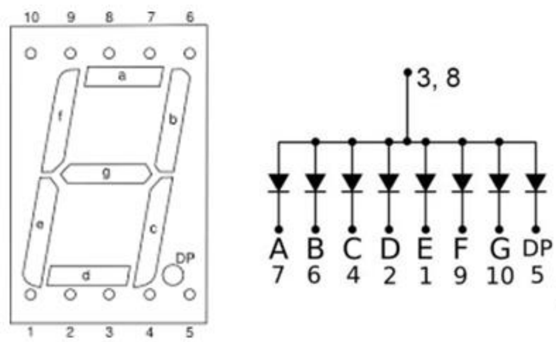
Refer to the PowerPoint slides for detailed working principle of the circuit diagram. Discuss with your partner the working principles of the Display Board, please ASK if you are still not sure.

<u>Step 3:</u> Assemble components and obtain their physical layout/Pin configurations

	Description	Qty/set
Components for Display Board	ULN2003A	1
	LED – 7-segment Common Anode	1
	5 way connector	2
	Resistor 330 Ω 0.25W	7
	IDC wire connector system (header & socket) 2.5 mm 10 way	2
	IC socket – 16 pins	1
	Strip board (Width ~24 holes; Length ~ 28 holes)	1
	Single – core jumper wire (3 colours)	-

List of components



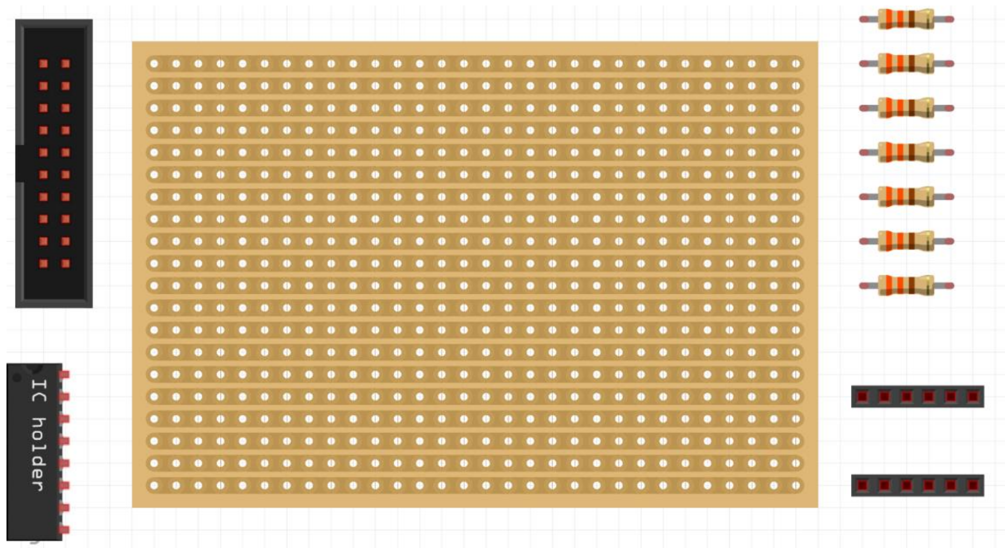


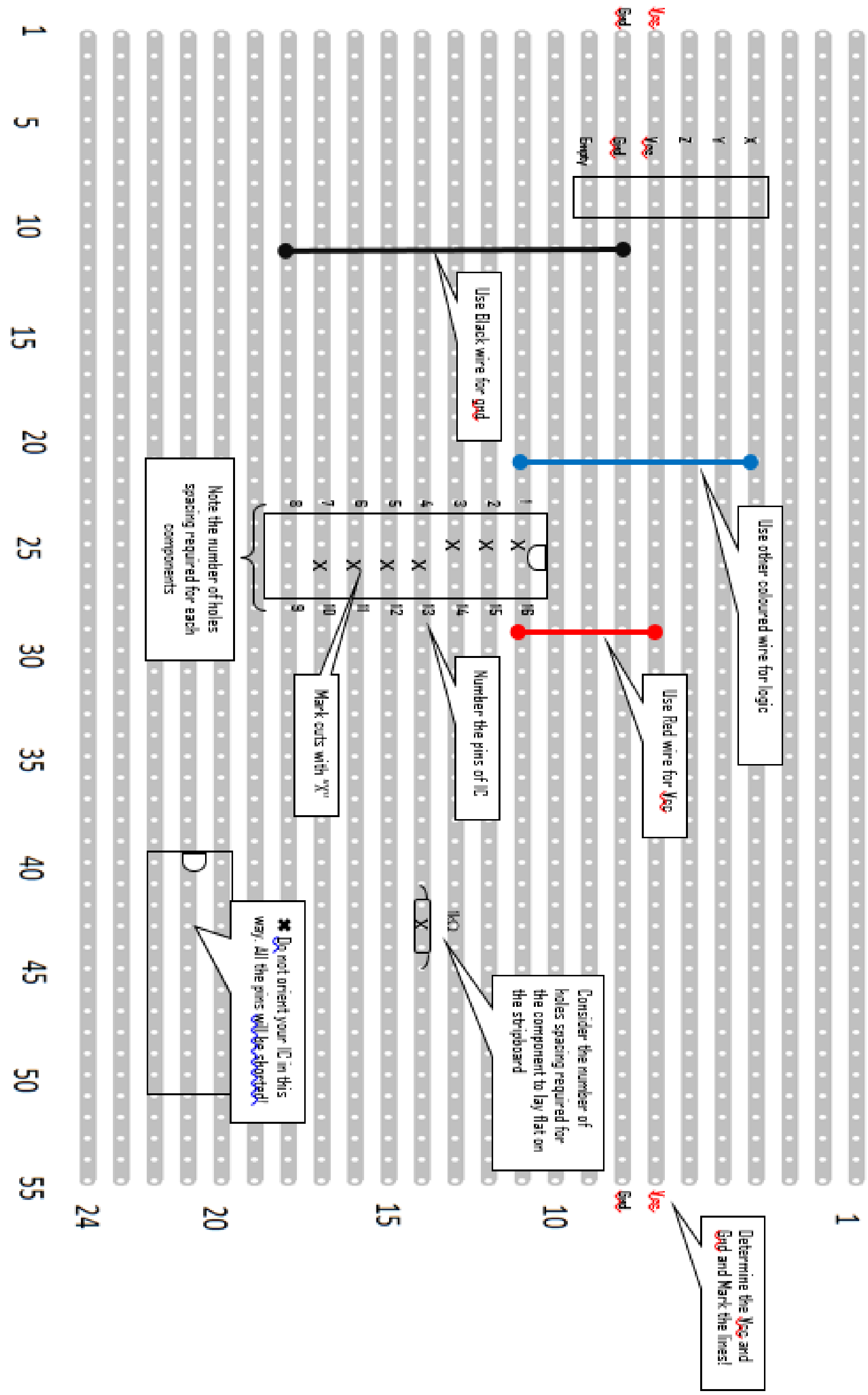
Physical layout/Pin configurations

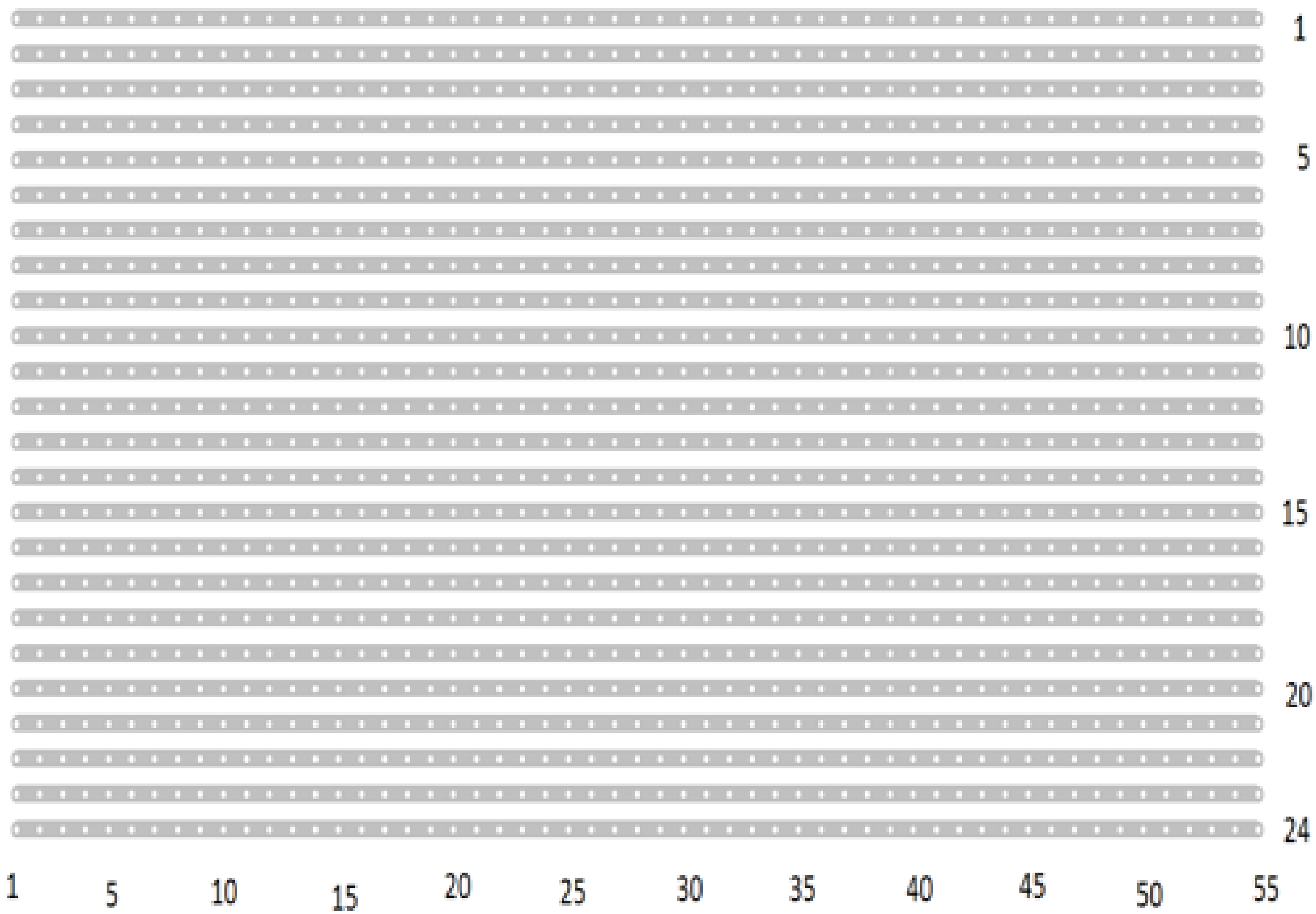
Note:
The LED anodes are connected to pins 3,8 and to 5V.
The LED cathodes are connected to the 330Ω resistors and to the buffer ULN 2003A.

Step 4: Plan your Components' Layout

Before you proceed with the fabrication of the Display Board on the strip-board, plan the layout of the jumper wires, components, etc on the 'strip-board layout planning sheet'. Remember to get your lecturer-in charge to check before you proceed.

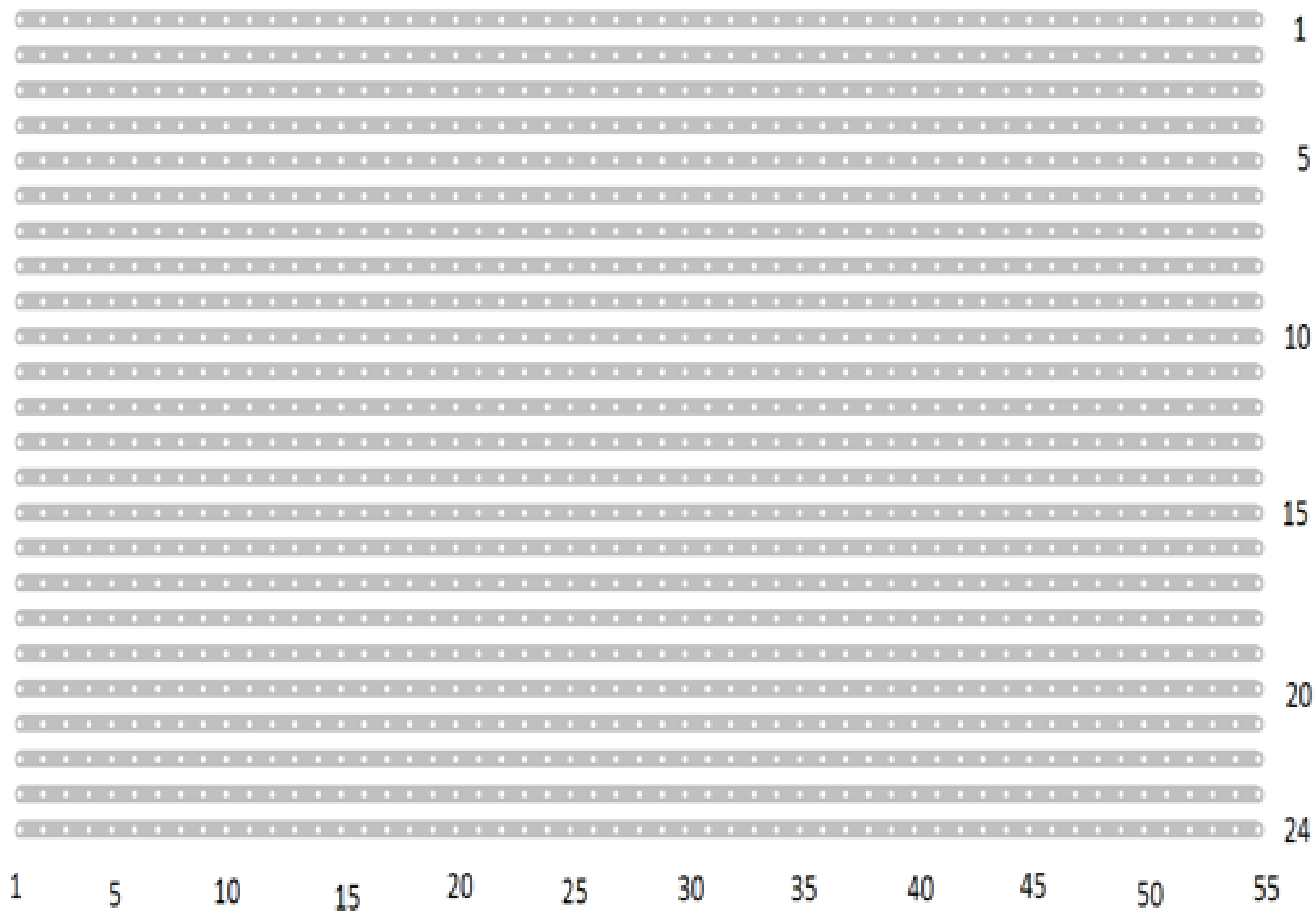



Use Black wire for gnd
Use other coloured wire for logic
Use Red wire for Vcc
Number the pins of IC
Mark cuts with "X"
Note the number of holes spacing required for each components
Do not orient your IC in this way. All the pins will be shorted!
Consider the number of holes spacing required for the component to lay flat on the stripboard
Determine the Vcc and Gnd and Mark the lines!
1kΩ
X
Y
Z
Vcc
Gnd
Empty



Tips:
Note the number of gap holes spacing required for each components.
Always number the pins of the ICs/Components
Mark out the Vs and Gnd power lines
Mark the cuts on the diagram with an "X".

Project:	
Size of the Stripboard	_______ rows : _______ columns
Designed by:	
Version:	
Date:	
Checked by:	



Tips:
Note the number of gap holes spacing required for each components.
Always number the pins of the ICs/Components
Mark out the Vs and Gnd power lines
Mark the cuts on the diagram with an "X".

Project:	
Size of the Stripboard	______ rows : ______ columns
Designed by:	
Version:	
Date:	
Checked by:	

Step 5: Solder the components

Step 6: Complete the Remaining Connections using Wires (if any)

Step 7: Break the copper track according to your layout plan

Step 8: Perform Visual Inspection and Continuity Test

Do a visual inspection and check for any mistakes in your connection on the strip board or look up for any soldering problems.

Use DMM to check for any open or short circuit connections.

Step 9: Test and check if your Stripboard works

Step 10: Check and troubleshoot if necessary

7 –Segment Board
Self-Directed Learning Guide

To be successful in self-directed learning, one must be able to engage in self-reflection and self-evaluation of his/her learning goals and progress in a unit of study. To support your learning progress in IE/(IE1), we have created a list of learning milestones so that you are able to monitor and evaluate your own learning. If you can't achieve the learning milestones in your first attempt, don't get discouraged! List down the learning challenges in your BCA form! Discuss with your team member and lecturer and see what learning resources/strategies you need to overcome your learning challenges.

Name	
Admin No	

Learning goals: Learn the skills on how to make circuit on a stripboard
Completion Date:

While doing my layout planning, I am able to

- ☐ plan the position of the components so that it uses the connections already on the stripboard as much as possible. (i.e. less connecting wires)
  label the numbering of the ICs, Vcc and Ground, …etc clearly on the planning sheet.

For electrical safety & Housekeeping, I am able to

- ☐ setup the soldering working area in a safe manner.
- ☐ ensure electrical safety practices and perform basic tool and equipment housekeeping (e.g. turn off the power when not using, wires do not fly all over while stripping) at all times.

While fabricating the stripboard, I am able to

- ☐ use RED wire for Vcc.
- ☐ use BlACK wire for Ground.
- ☐ use coloured wires to represent logic lines.
- ☐ use proper wire length and layout my wiring in a neat manner.
- ☐ apply solder such that the soldered joints looks smooth, shiny and cling to the metals for proper connections.

Before I test the board,

- ☐ I have visually inspected the board to check if there are any soldering problems.
  I am able to use the digital multimeter to carry out the test procedures to check if
  - ☐ Vcc and Ground are not shorted.
  - ☐ all the tracks between the pins of an IC are not shorted after breaking them.
  - ☐ The logic inputs are not shorted (unless they are meant to)
  - ☐ The lCs are properly wired to Vcc and Ground.

While testing of the board, I am able to

- ☐ test the board and show the working piece to my lecturer.

While troubleshooting the board

- ☐ I am able to explain how the circuit works (revisit the lecture slides on how the circuit works).
- ☐ I am able to identify the problem encountered. e.g. LED segment b is not working as intended.
- ☐ I am able to use the digital multimeter to identify and trace where the problem lies.
- ☐ I have done all the necessary checking and testing before I seek assistance from my lecturer.

Lecturer in Charge: ______________________ Submission Date: ________________________
Signature

Session 3: Creating Your Own Logic Board (Individual)

Difficulty Level: ★★★★☆

Estimated Duration: _____ hours

Submission date: ________________

<u>Step 1:</u> Create a schematic diagram based on the given scenarios:

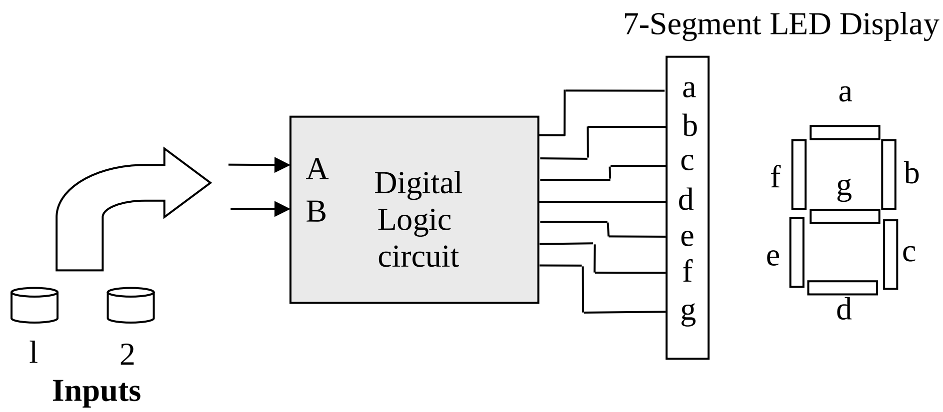


Figure 1: Block Diagram

Design process

You are required to design a digital logic circuit as shown in Figure 1 that will detect the AB inputs and produce an appropriate display on the 7-segment LEDs. [A logic '1' is required to light each led (a to g) in the 7-segment led display.]. For example, when BA = 00, the 7-segment LED displays an "E". Discuss with your team mates why you think an "E" was chosen and what it could represent? What other display pattern do you consider appropriate for BA = 00.

i. Construct the truth table for your preferred output display.

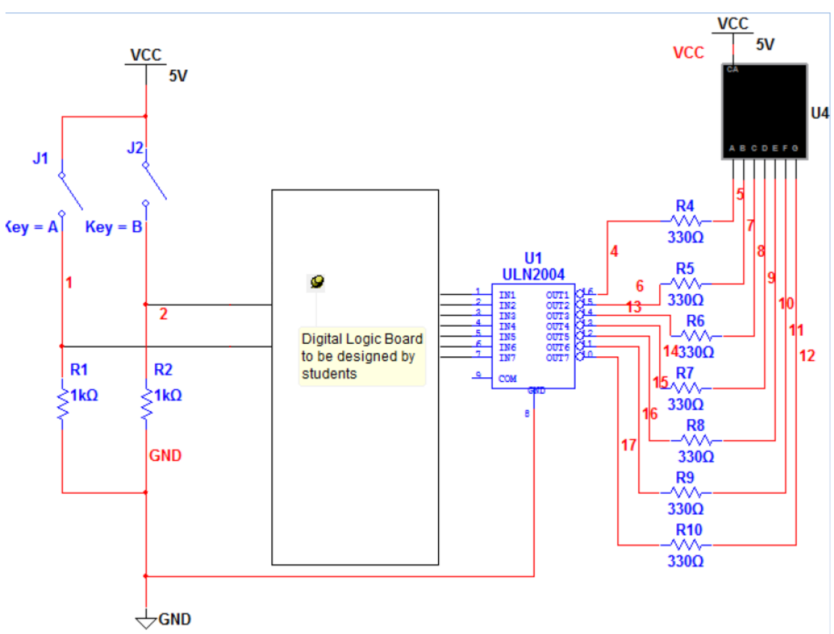
B	A	Output for 7-Segment LED Display	a	b	c	d	e	f	g
0	0								
0	1								
1	0								
1	1								

ii. Evaluate the circuit implementation using basic gates (*i.e. AND, OR and NOT*) against using only one type of gate. State what is your choice and why.

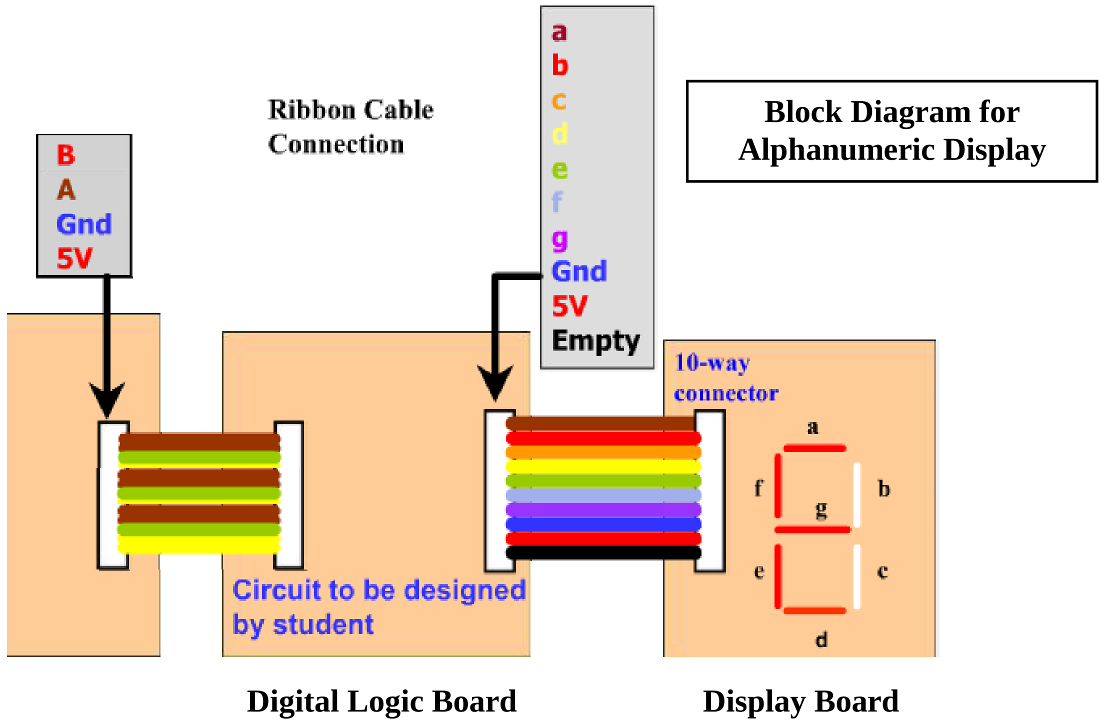
iii. Derive all the Boolean equations for LED segments a to g and draw the circuit implementation using only NAND gates.

Step 2: Understand and verify the circuit diagram

Simulate the circuit using NI Multisim to verify if your logic is correct. **Show to your lecturer.**

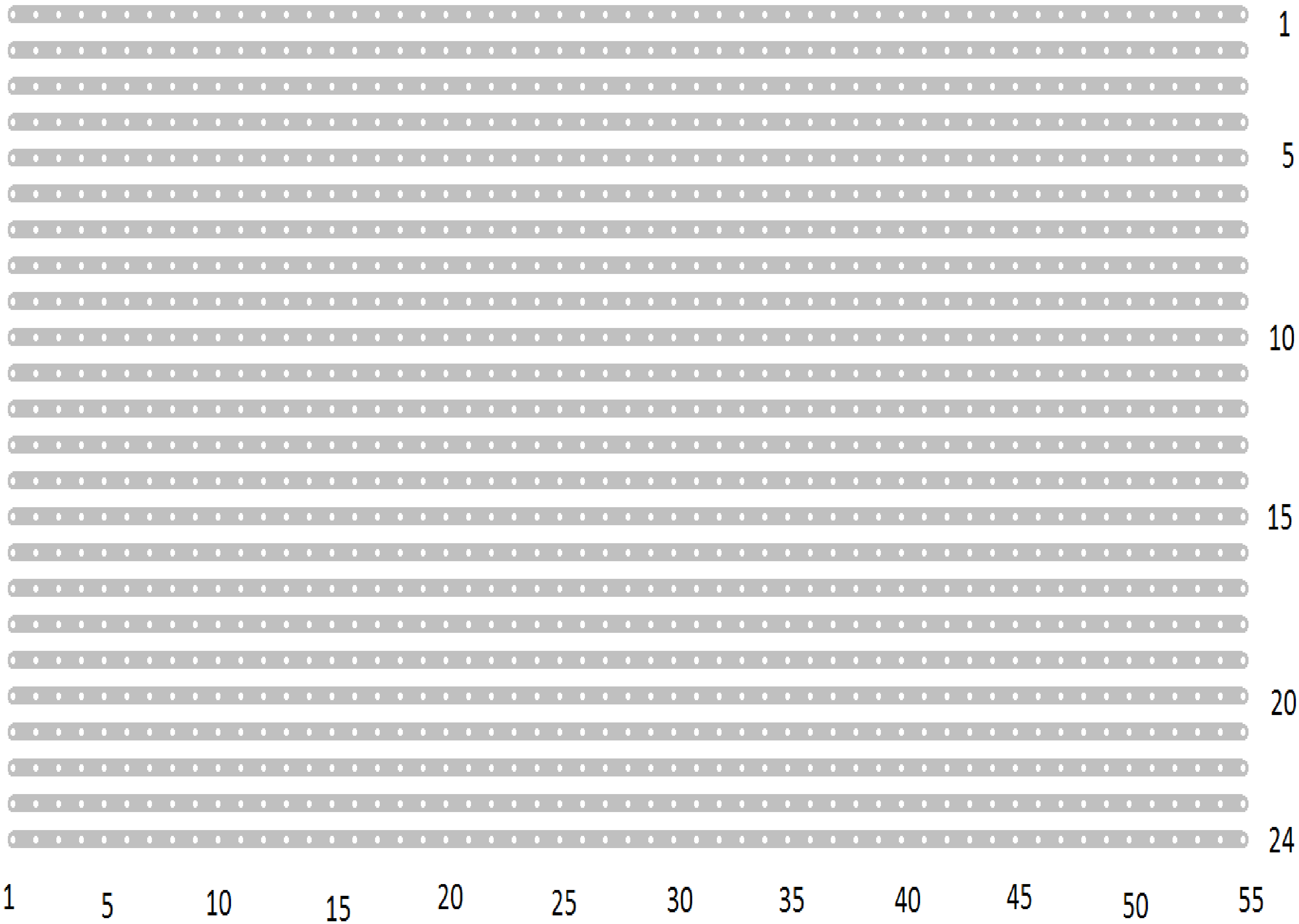


<u>Step 3:</u> Assemble components and obtain their physical layout/Pin Configurations



	Description	Qty/set
Components & cable for your Logic Board	4 way connector	2
	IDC wire connector system (header & socket) 2.5 mm 10 way	2
	IC socket – ____pins	
	Strip board (Width ~24 holes; Length ~ 28 holes)	1
	Single – core jumper wire (3 colours)	-
	DIY molex cable	
	DIY ribbon cable	

Step 4: Plan your Components' Layout



Version: ____________

Version: ____________

Step 5: Solder the components

Step 6: Complete the Remaining Connections using Wires (if any)

Step 7: Break the copper track according to your layout plan

Step 8: Eight Perform Visual Inspection and Continuity Test

Always do a visual inspection to check for any mistakes in your connections and soldering problems.

Learn to use DMM to check for any open or short circuit connections.

Step 9: Test and check if your Stripboard work

Did you get the same reading to what you expected in step 2?

Step 10: Check and troubleshoot if necessary

Group member	Name	Admission No
1		
2		
3		
4		

Learning goal(s): Learn to create schematic diagram and how to make circuit prototyping using Stripboard

Completion Date:

Logic Design

- ☐ Decide on how the display shown on the 7-segment display and derive the truth table.
- ☐ Able to derive all the Boolean equations for all the LED segments (from a to g).
- ☐ Draw the circuit implementation using only NAND gates
- ☐ Simulate the circuit using NI MultiSim to verify if your logic is correct. Show to your lecturer.

Lecturer's signature :____________________

While doing my layout planning, I am able to

- ☐ plan the positioning of the components so that it uses the connections already on the stripboard as much as possible.
- ☐ label the numbering of the ICs, Vcc and Ground, …etc clearly on the planning sheet.

For electrical safety & housekeeping, I am able to

- ☐ setup the soldering working area in a safe manner.
- ☐ ensure electrical safety practices and perform housekeeping at all times.

While fabricating my board, I am able to

- ☐ use RED wire for Vcc.
- ☐ use BlACK wire for Ground.
- ☐ use coloured wires to represent logic.
- ☐ use proper wire length and layout wiring in a neat manner.
- ☐ apply solder such that the soldered joints looks smooth, shiny and cling to the metals for proper connections.

Making of the Molex cable/ribbon cable, I am able to

- ☐ use the tools correctly to make the Molex cable/ribbon cable.
- ☐ know how to test continuity before using it.

Before I test my board

- ☐ I have visually inspected the board to check if there are any soldering problems.

I am able to use the digital multimeter to carry the test procedures to check if

  - ☐ Vcc and Ground are not shorted.
  - ☐ The tracks between the pins of an IC are not shorted after breaking them
  - ☐ The logic inputs are not shorted (unless they are meant to)
  - ☐ The lCs are properly wired to Vcc and Ground.

While testing of the board, I am able to

- ☐ test the board and show the working piece to your lecturer.

While troubleshooting the board

- ☐ I am able to explain how the circuit works.
- ☐ I am able to identify the problem encountered. e.g. LED segment b is not working as intended.
- ☐ I have done all the necessary checking and testing before I seek assistance from my lecturer.
- ☐ I am able to use the digital multimeter to identify and trace where the problem lies.

<u>LDR Sensor Circuit</u>

(To be designed and milled by students)

The LDR (light dependent resistor) and resistors (fixed and variable) form a potential divider. A potential divider is used to split voltage in a series circuit. This theory is put to good use in sensing circuits. We shall explore how a light dependent resistor (LDR), whose value depends upon the incident light intensity, can be used as part of a potential divider in order to control the voltage in a circuit. The LDR behaves as per amount of light and its output directly varies with it. The LDR resistance is minimum (ideally zero) when it receives maximum amount of light and goes to maximum (ideally infinite) when there is no light falling on it. The voltage output V_{out} can be changed by variations in the value of the LDR.

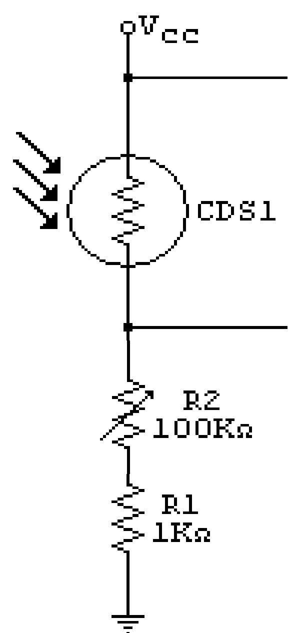


Figure 1: The LDR Potential Divider Circuit

Discuss with your team members on the working principles of the above circuit.

____

____

What is the function of LDR (light dependent resistor)?

____

____

Measure the resistance of the LDR when it is covered by your finger and when it is not covered.

____

____

What happens at V_{out} when light is shone at the LDR and when light shining at the LDR is obstructed?

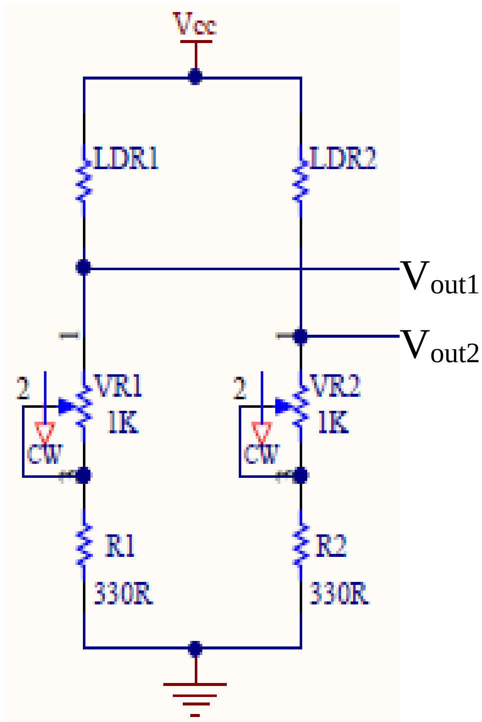


Figure 2: LDR Sensor Circuit

The outputs at V_{out1} and V_{out2} are each connected to an NOT gate. What is the function of the variable resistors VR1 and VR2? What is the voltage level which is considered a LOW input by the NOT gate? You need to adjust the VR so as to satisfy the requirement for a LOW input.

____

____

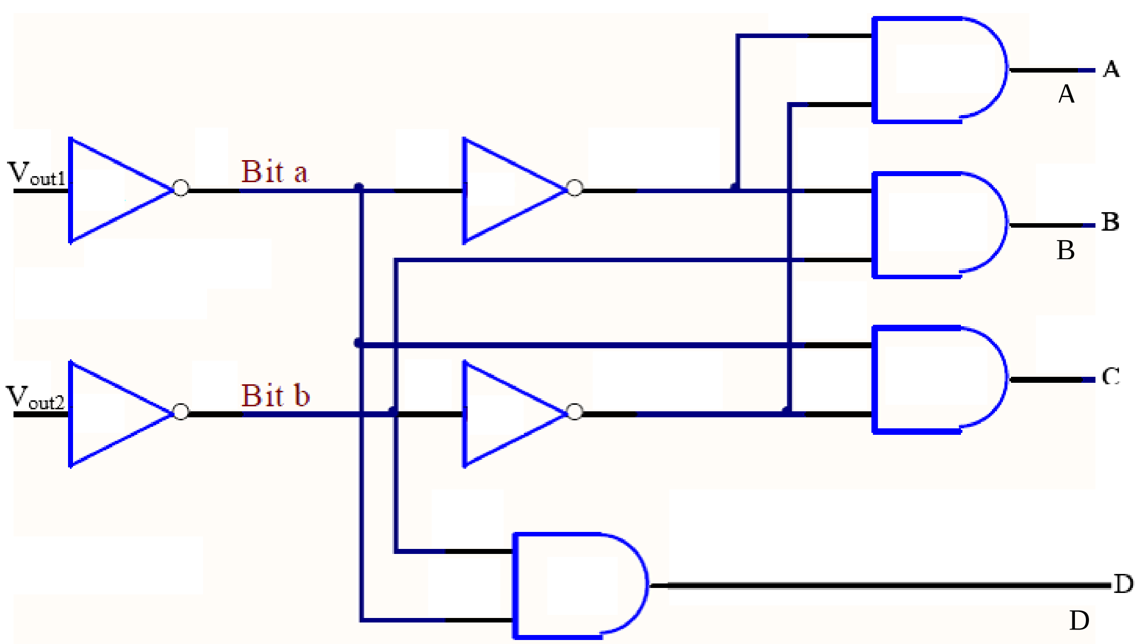


Figure 3: Decoder Circuit

Fill in the table below for the different outputs at A, B, C and D

Bit a	Bit b	A	B	C	D
0	0				
0	1				
1	0				
1	1				

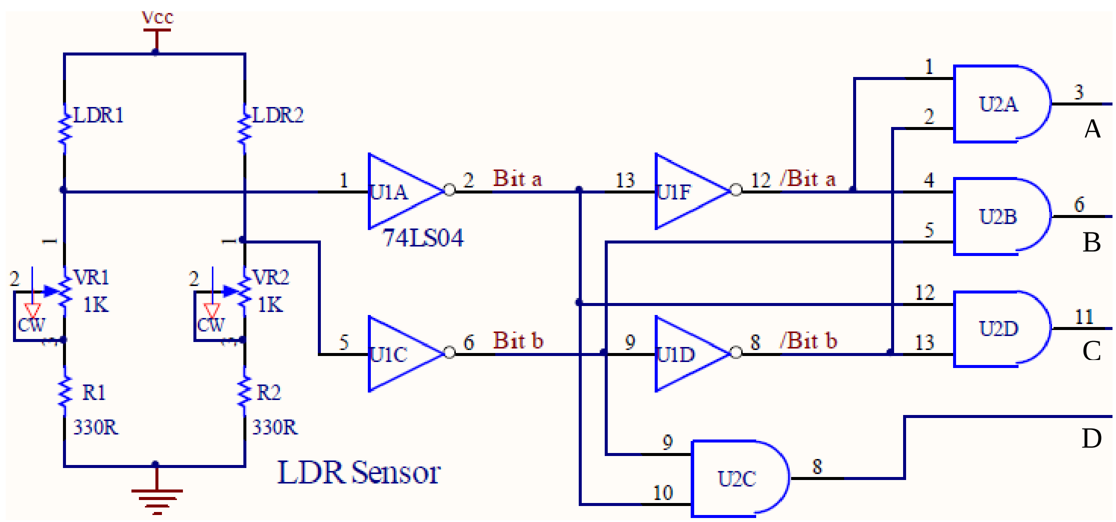


Figure 4: LDR sensor with decoder

Assemble and solder all the components (as shown in Figures 4) onto the given printed circuit board.

Analyse and test the output signals at A, B, C and D when the light shining on the LDR is interrupted. (You may wish to simulate the circuit using Multisim)

Tone Generator Circuit

The circuit diagram for the astable multivibrator using IC 555 is shown in Figure 5. The 555 timing circuit is a highly stable controller capable of producing oscillation. For astable operation as an oscillator, the free running frequency and the duty cycle are both accurately controlled with two resistors, R_1 and R_2, and one capacitor, C, which are externally connected to the 555 timer.

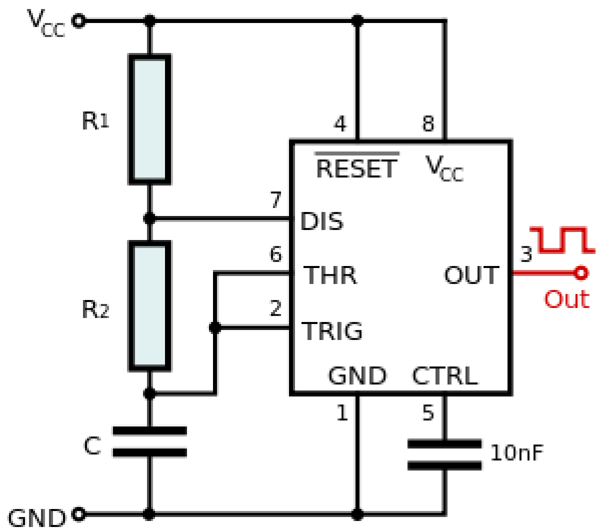


Figure 5: Astable Multivibrator Circuit

When the circuit is connected as shown in Figure 5, it triggers itself and free runs as a multivibrator. The external capacitor C charges through R_1 and R_2, and discharges through R_2 only. Thus the duty cycle is set by the ratio of these two resistors. In the astable mode of operation, C charges and discharges between 1/3 V_{cc} and 2/3 V_{cc}. As in the triggered mode, the charge and discharge times and therefore frequency are independent of the supply voltage.

The charge time (output HIGH) is given by:

$$t_{High} = 0.693 (R_1 + R_2) C_1$$

and the discharge time (output LOW) by:

$$t_{Low} = 0.693 (R_2) C_1$$

Thus the total period T is given by:

$$T = t_{High} + t_{Low} = 0.693 (R_1 + 2R_2) C_1$$

The frequency of oscillation is given by:

$$f = \frac{1}{T} = \frac{1.44}{(R_1 + 2R_2)C_1}$$

The duty cycle is given by:

$$D = \frac{R_1 + R_2}{R_1 + 2R_2}$$

What will happen to the output waveform if the value of R_1 is increased?

____

____

Will changing the value of C affect the output frequency? Explain.

____

____

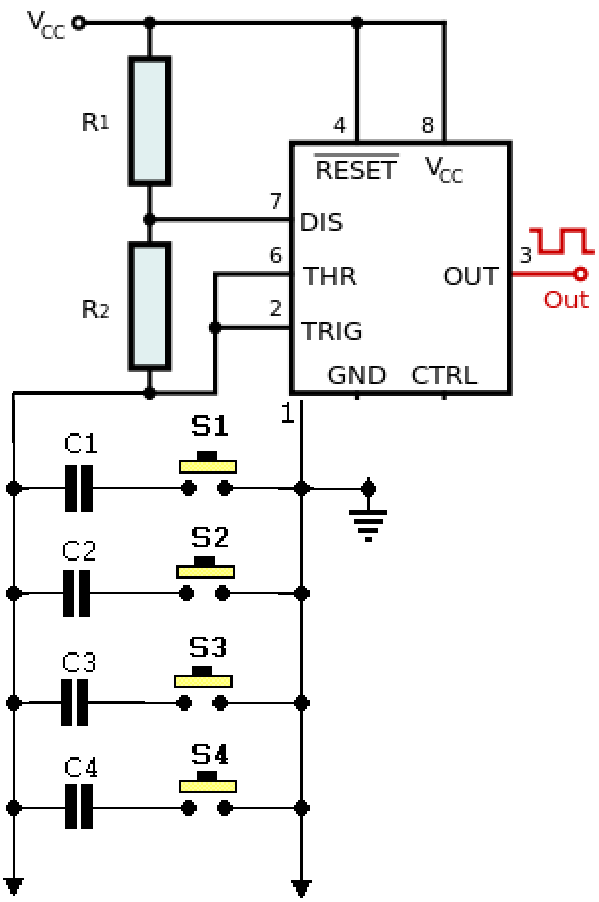


Figure 6: Circuit Diagram for a Tone Generator

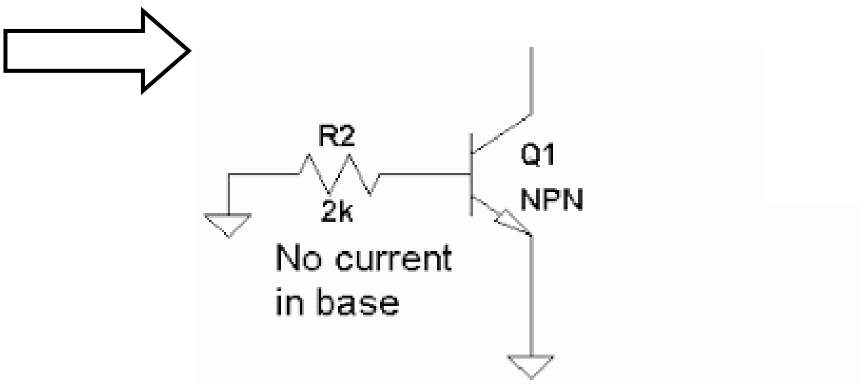
The main component of this circuit is the 555 timer IC, configured as an astable multivibrator. A 555 configured as such outputs an oscillating signal with a frequency determined by the values of R_1, R_2, and the capacitor connected between pin 1 and pin 2.

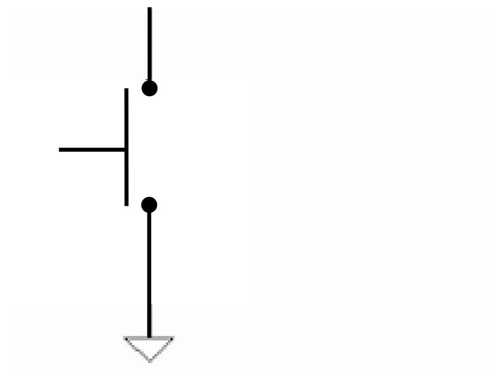
Every time one of the switches is pressed, a capacitor of a certain value is connected to the 555, causing it to deliver a signal of corresponding frequency at pin 3. If a speaker (with amplifier) is connected at pin 3, by choosing the capacitor values well, tones produced may mimic those of an organ. The number of 'keys' in electronic organ may be increased by adding more switches and capacitors.

Transistors (BJTs) as Switches

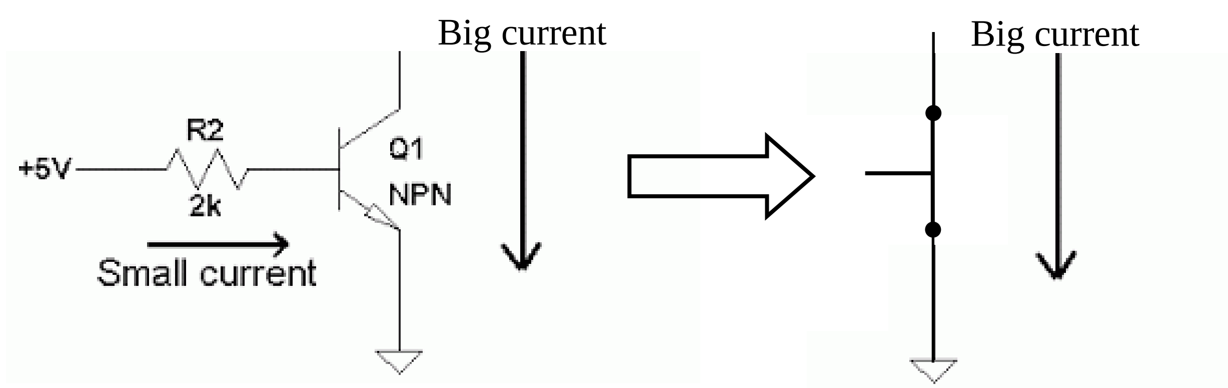
The easiest way to understand transistors is to think of them as switches. Transistor is a current-controlled device. As the current flows through the base of the transistor, it works like a close switch. You can switch a big current (between the collector and emitter) with a much smaller current (in the base). Let's look at a circuit diagram below.

When there is no current in base of the transistor, the transistor is in cut-off state. Hence, the transistor acts as an open switch and there is no current flowing in the circuit.





When the current flows in the base of the transistor, the transistor is in saturation state. Hence, the transistor acts as a close switch and there is current flowing in the circuit.



The mechanical switches (S1, S2, S3 and S4) in Figure 6 are replaced by BJTs as shown in Figure 7. Any current on the base sufficient to drive the transistor to saturation will turn on the transistor.

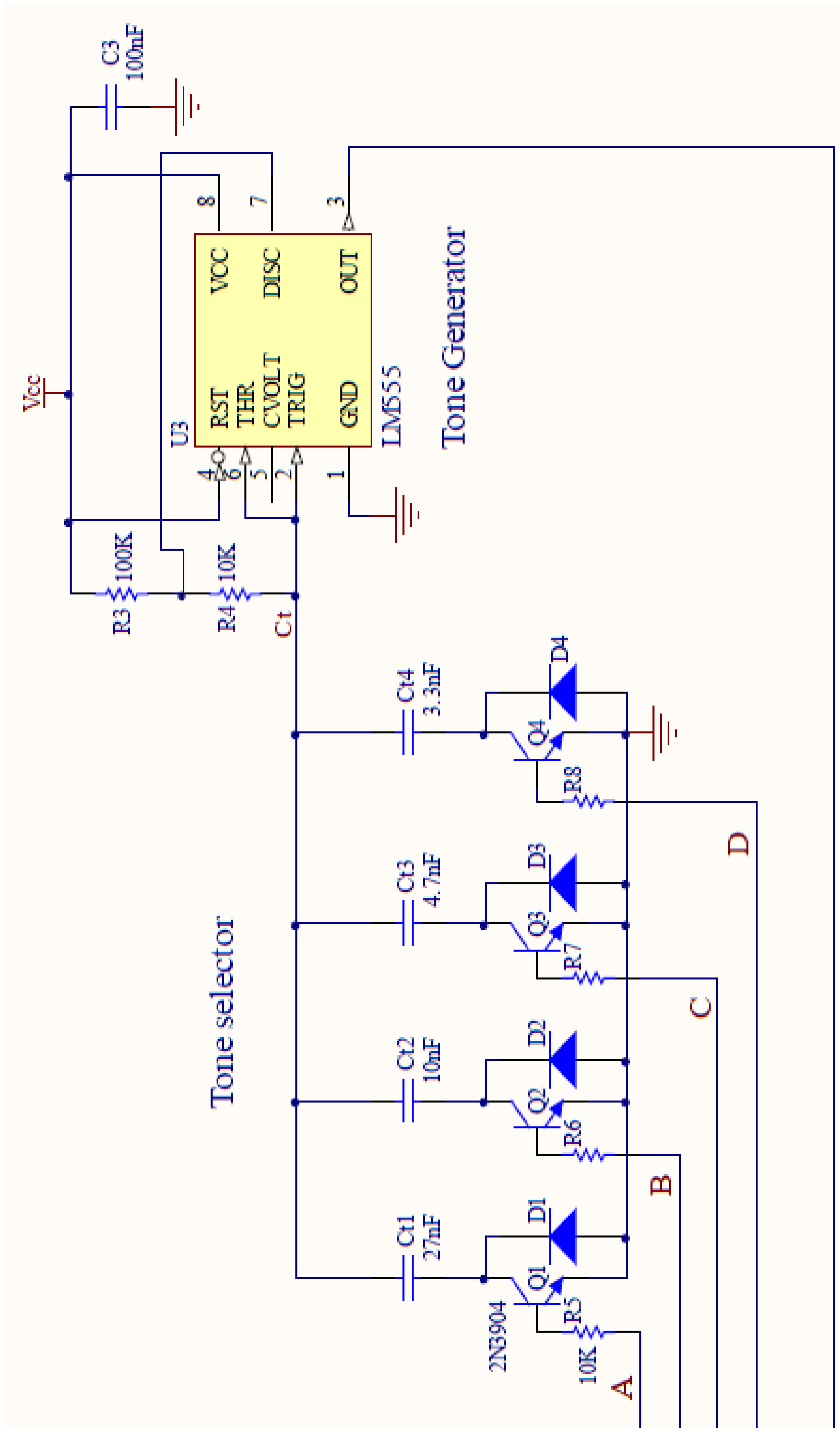
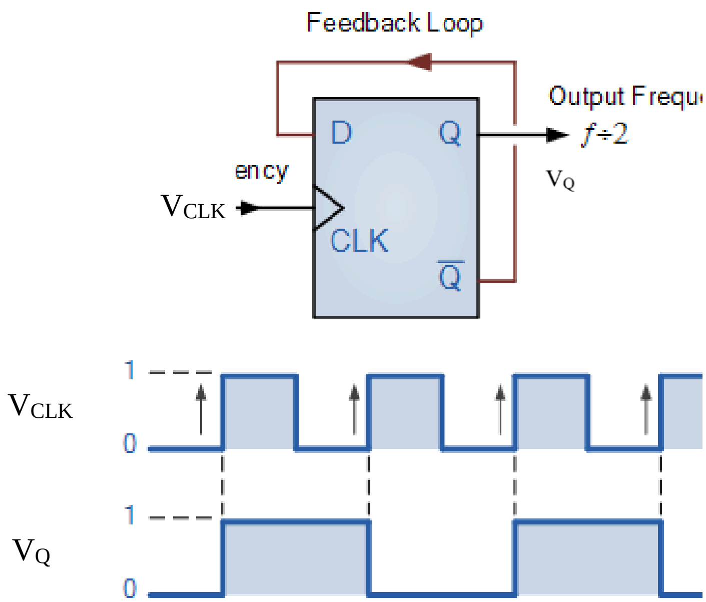


Figure 7: Tone Generator with mechanical switches replaced by BJTs.

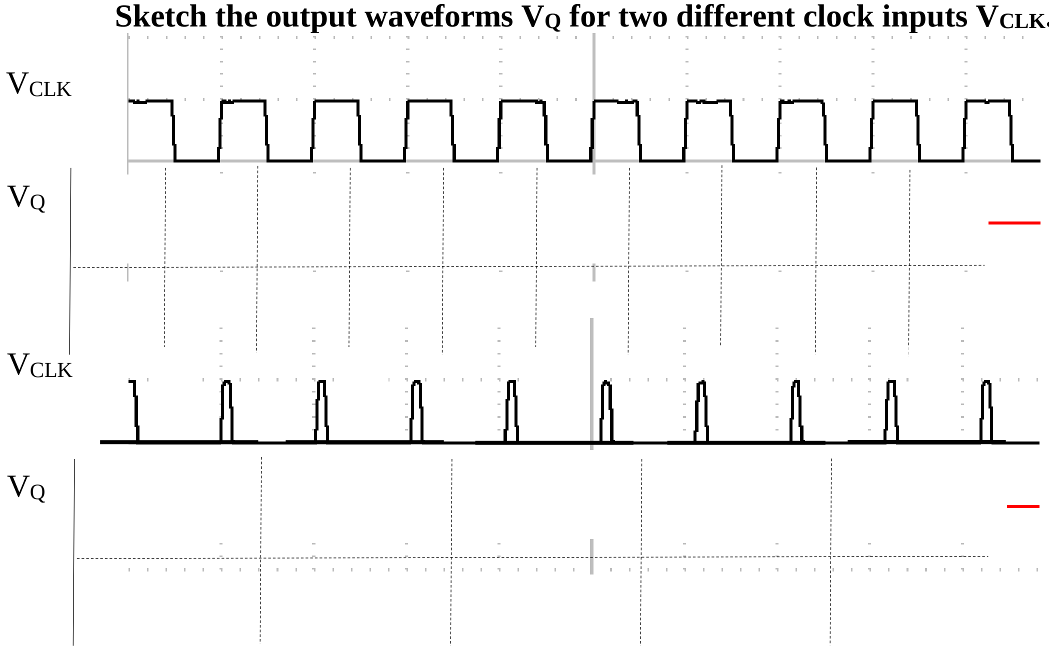
Square Wave Generator

One useful feature of the D-type Flip-Flop (IC 74LS74) is that it can be wired into a square wave generator by configuring the IC as a Toggle FF. The inverted output terminal $\overline{Q}$ is connected directly back to the Data input terminal D giving the device "feedback" as shown below.



It can be seen from the waveforms above, that on the rising edge of the clock pulse, D is copied to Q. Since $\overline{Q}$ is connected to D, the data is inverted on each rising edge. The output of this circuit is high for 50% of the time and low for 50% of the time. The output duty cycle is therefore always 50% irrespective of the input waveform duty cycle. The flip-flop toggles the output at every rising edge of the clock input.

Sketch the output waveforms V_Q for two different clock inputs V_{CLK}.



Assemble and solder the component (as shown in Figures 8) onto the given printed circuit board.

Analyse and verify the output signal at pin 5 is at 50% duty cycle when the light shining on the LDR is interrupted.

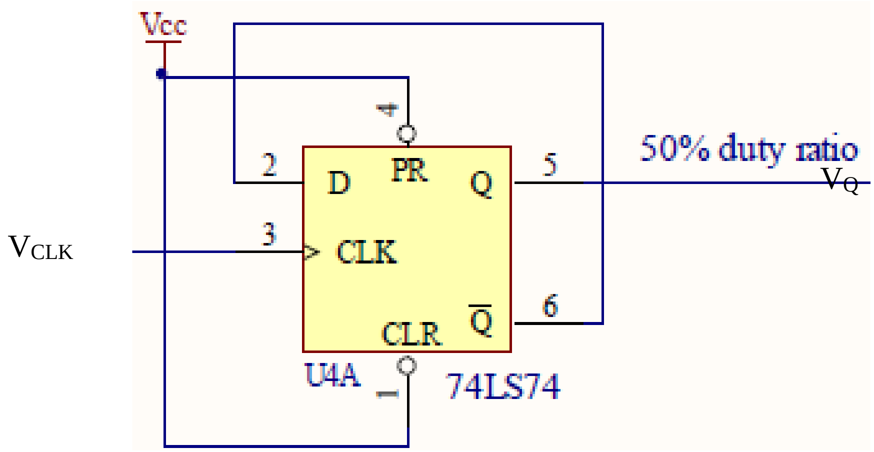


Figure 8: Square Wave Generator Circuit

Bill of Materials

	Description	Designation	Qty
Components for LDR Sensor and Decoder Boards	Variable Resistors – 1kΩ	VR1, VR2	2
	Resistors - 330Ω	R1, R2	2
	Light Dependent Resistors (LDRs)	LDR1, LDR2	2
	Hex Inverter – 74LS04	U1	1
	Quadruple 2-input Positive-AND Gate – 74LS08	U2	1

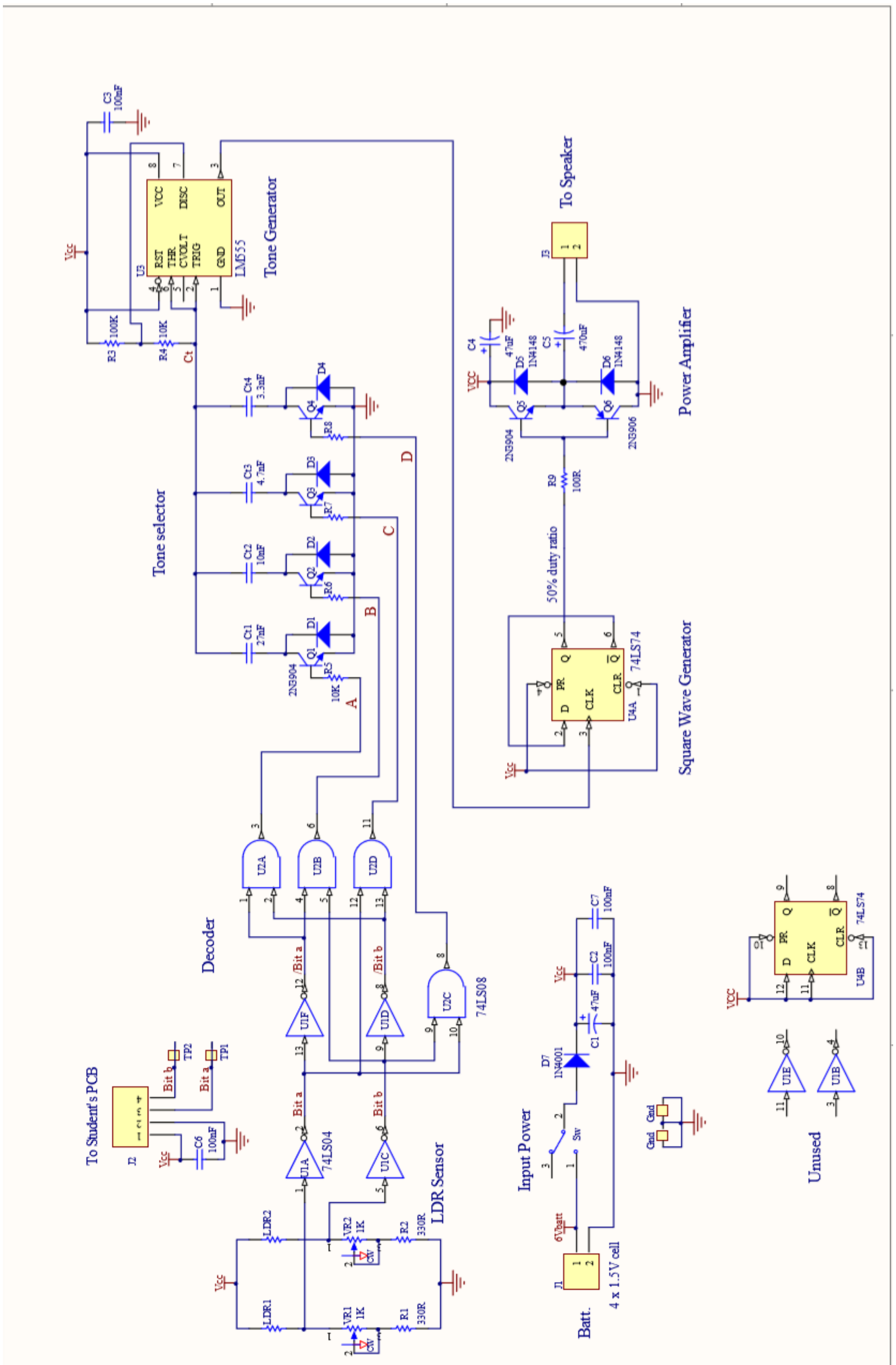
Components for Tone Generator	Timer – LM555	U3	1
	Resistors – 100kΩ	R3	1
	Resistors – 10kΩ	R4, R5, R6, R7, R8	5
	NPN Transistors – 2N3904	Q1, Q2, Q3, Q4	4
	High Conductance Fast Diode – 1N4148	D1, D2, D3, D4	4
	Capacitors – 27nF, 10nF, 4.7nF, 3.3nF	Ct1, Ct2, Ct3, Ct4	4
	Capacitor – 100nF	C3	1

Components for Input Power	Header, 2-Pin	J1	1
	Polarized Capacitor (Radial) – 47uF	C1	1

	Capacitor – 100nF	C7	1
	Capacitor – 100nF	C2	1
	SPDT Switch	SW	1
	1A General Purpose Rectifier – 1N4001	D7	1

Components for Power Amplifier	Resistor - 100Ω	R9	1
	High Conductance Fast Diode – 1N4148	D5, D6	2
	NPN Transistor – 2N3904	Q5	1
	PNP Transistor – 2N3906	Q6	1
	Polarized Capacitor (Radial) – 470uF	C5	1
	Polarized Capacitor (Radial) – 47uF	C4	1
	Header, 2-Pin	J3	1

Components for Square Wave Generator and Connecting Block to Student's PCB	Dual D-Type Positive-Edge-Triggered Flip-Flop with Preset and Clear – 74LS74	U4	1
	Test Point – Bit a	TP1	1
	Test Point – Bit b	TP2	1
	Capacitor – 100nF	C6	1
	Header, 4-Pin	J2	1
	Gnd	Gnd1, Gnd2	2


Tone Generator
LM555
Tone selector
Decoder
74LS08
74LS04
LDR Sensor
To Student's PCB
Input Power
Batt.
4 x 1.5V cell
Square Wave Generator
74LS74
50% duty ratio
Power Amplifier
To Speaker
Unused

Reflection Log Exercise

General

1. What did you do well during this project?
2. What are the three most important things you learned during this project?
3. What is something you accomplished during this project that you are proud of?
4. If you could change one thing that happened during this project, what would it be?
5. What were the skills that you learnt during this module which you managed to apply to this project?

Working Effectively in Teams

1. How did your project group work together as a team?
2. What were some difficulties you faced when working in your team?
3. What are some advantages and/or disadvantages of working in a team?
4. What were some things you learnt about yourself and the way you work in teams?

Problem-Solving and Decision-Making

1. What were some problems your team faced during the project?
2. Were those problems successfully resolved? If yes, how so. If no, why not?
3. What were some things you learnt about your problem-solving and/or decision-making skills?