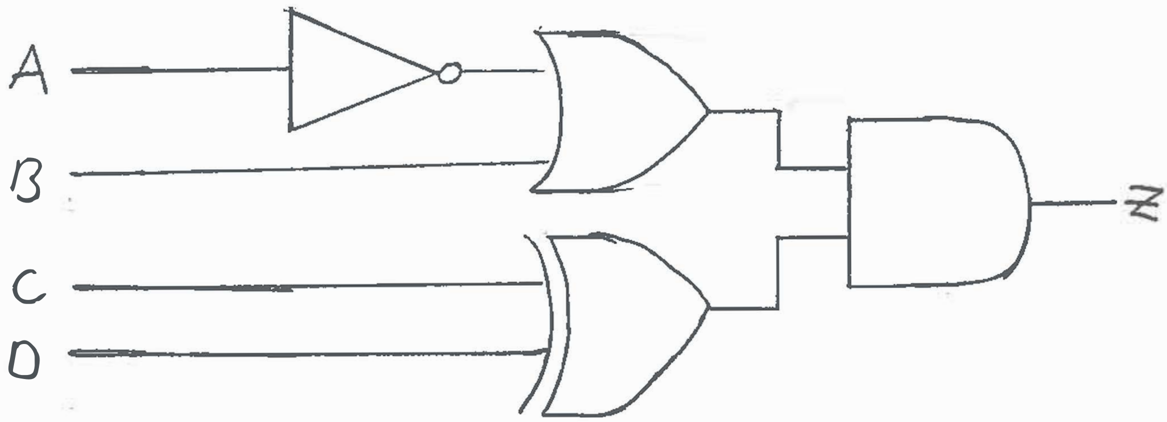
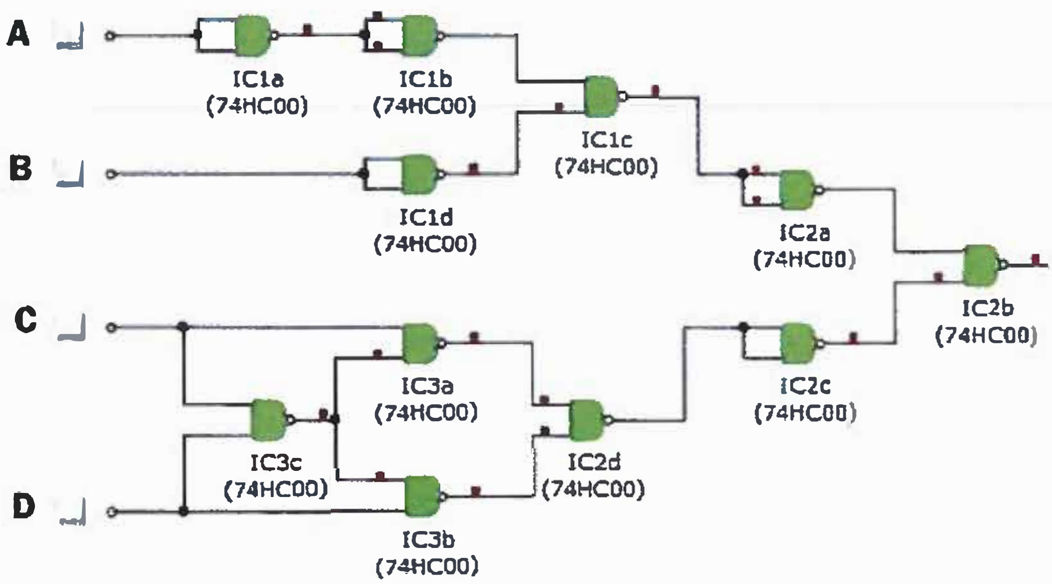
Candidate 1 evidence

Task One Ice Drinks Machine

1)a)



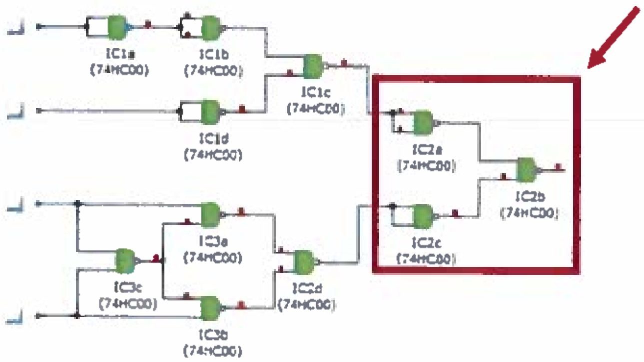
1)b)



1)c)

A	B	C	D	Expected results	Actual results
0	0	0	0	0	1
0	0	0	1	1	1
0	0	1	0	1	1
0	0	1	1	0	1
0	1	0	0	0	1
0	1	0	1	1	1
0	1	1	0	1	1
0	1	1	1	0	1
1	0	0	0	0	0
1	0	0	1	0	1
1	0	1	0	0	1
1	0	1	1	0	0
1	1	0	0	0	1
1	1	0	1	1	1
1	1	1	0	1	1
1	1	1	1	0	1

1)d) The Actual results differ as the engineer based them off the NAND equivalent circuit which compared to the Boolean equation has OR Logic highlighted here;

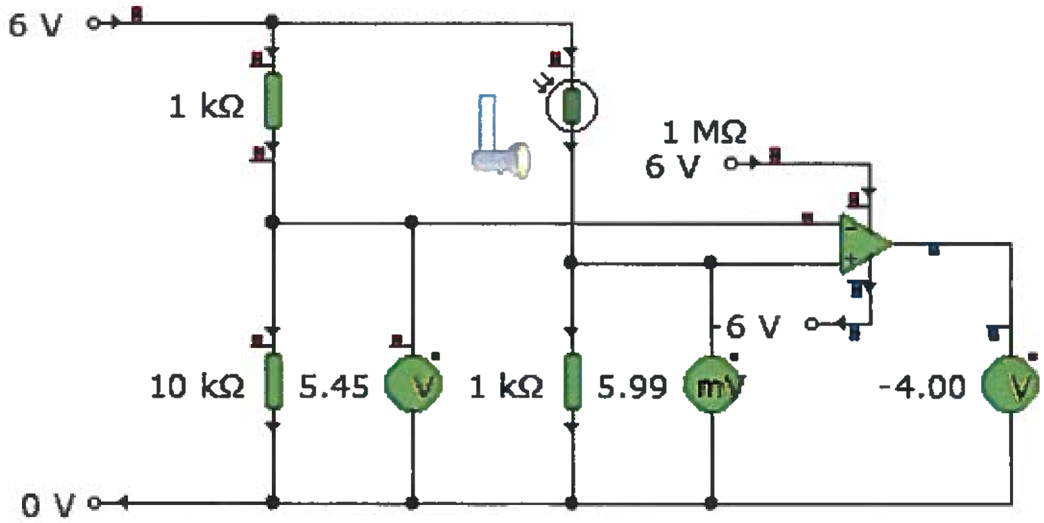


and the expected results are based off AND Logic in the Boolean Equation where the four inputs meet.

Task Two

Fast Pass Machine

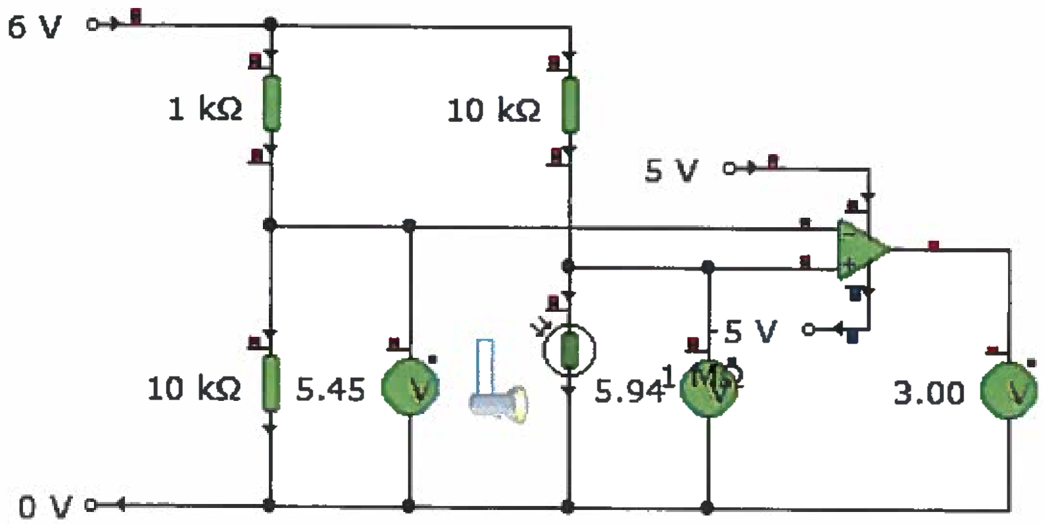
2)a)



2)b)

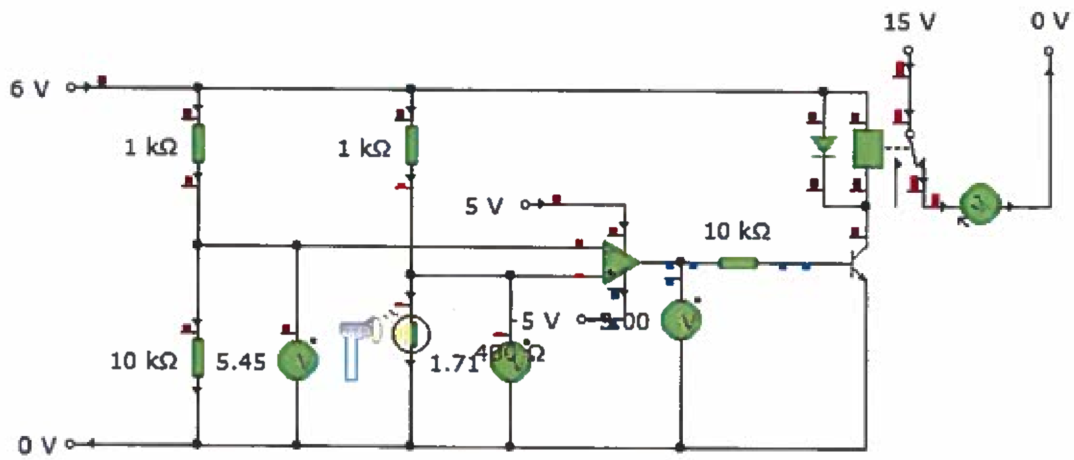
Planned test	Expected result	Actual result	Amendments made
Reduce the light level to the minimum setting.	Op amp output saturates positive.	Changing the light level does not change the op amp saturation. Then reducing light level to the minimum setting changes the op amp to saturate negatively.	LDR was swapped around with the 1KΩ resistor below to make the op amp work and saturate positively on the minimum light level setting
Alter the light level until op amp changes state.	Op amp output changes state at 3V.	Op amp output changes state at 4V	Op amp supply voltage was changed to 5V and -5V

2)b) (continued)



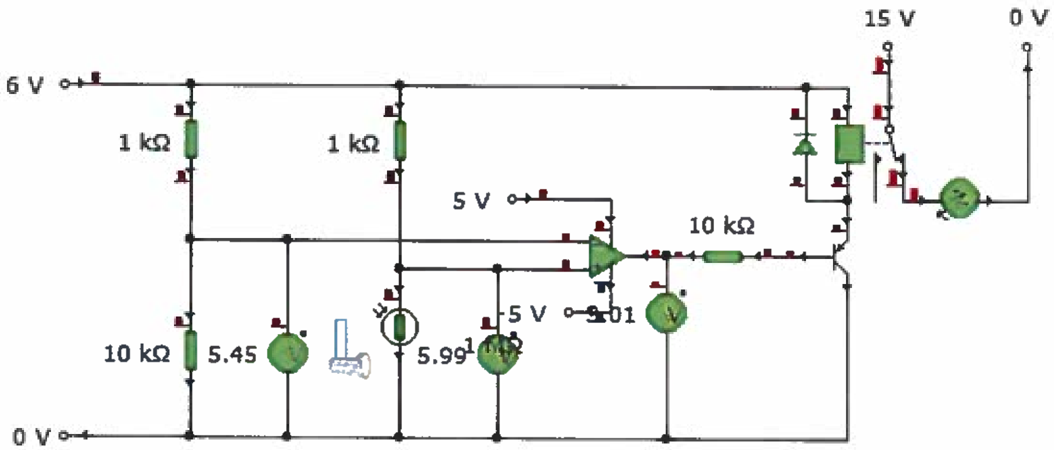
Amended Circuit

2)c)



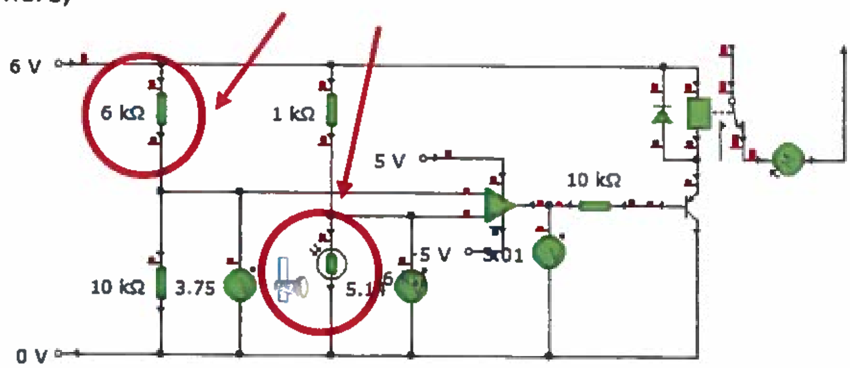
2)d)

Planned test	Expected result	Actual result	Amendments made
Reduce the light level to minimum.	Motor turns.	The motor does not turn on or off (relay does not switch) Motor then switches on when light is at maximum level	Diode was flipped 180 degrees NPN transistor was changed to a PNP transistor
Alter the value of both the LDR and the fixed resistor to 6kΩ.	The motor turns on under different lighting conditions.	The motor turns on under different lighting conditions	None



Amended Circuit

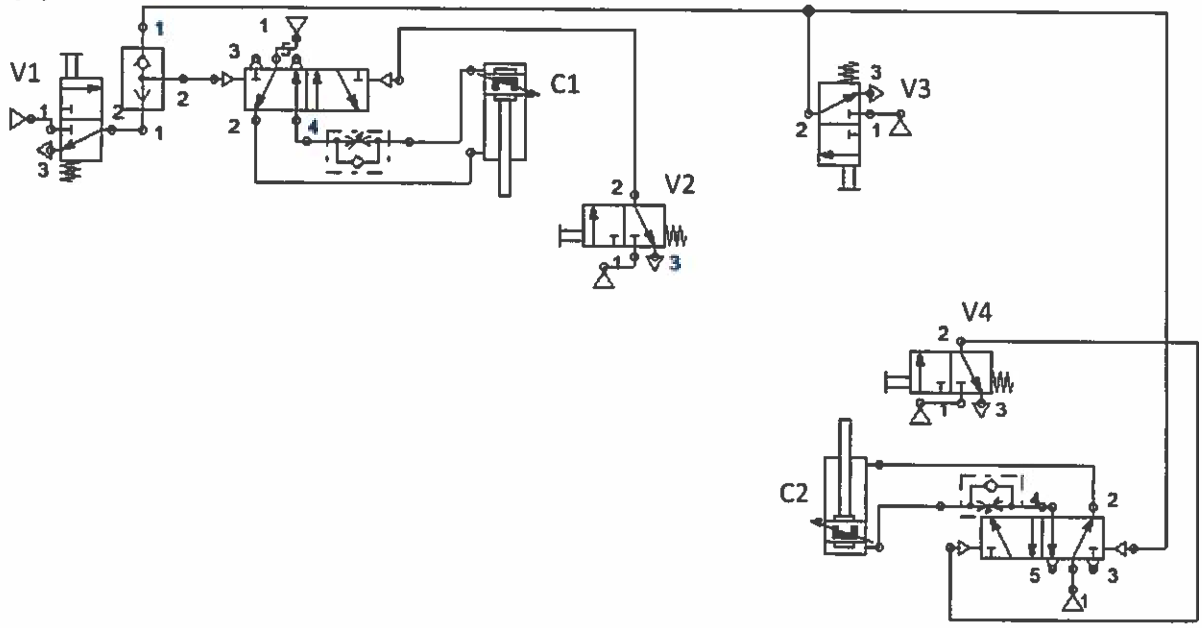
2)e) The amended circuit performs well against the specification. The fast pass motor now turns on when darkness is sensed by changing the NPN transistor to a PNP transistor. The motor then slows down to a rest after the ticket has been removed and the light level increases again due to the changed transistor. The scanners sensitivity can also be changed by adjusting the fixed resistors value and the LDR shown here;



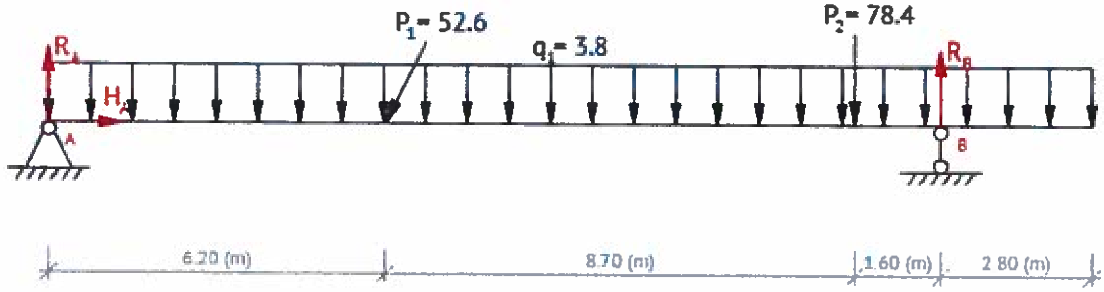
Task Three

Log Flume Ride

3)a)



3)b)



$\Sigma F_x = 0$: $H_A - P_1 * \cos(63) = 0$

$\Sigma M_A = 0$: The sum of the moments about the pin support at the point A:

$- q_1 * 19.3 * (19.3/2) - P_1 * \sin(63) * 6.2 - P_2 * 14.9 + R_B * 16.5 = 0$

$\Sigma M_B = 0$: The sum of the moments about the roller support at the point B:

$- R_A * 16.5 + q_1 * 19.3 * (16.5 - 19.3/2) + P_1 * \sin(63) * 10.3 + P_2 * 1.6 = 0$

2. Calculate reaction of roller support at the point B:

$R_B = (q_1 * 19.3 * (19.3/2) + P_1 * \sin(63) * 6.2 + P_2 * 14.9)$ **/ 16.5** = (3.8*19.3*(19.3/2) + 52.6*0.89106.2 + 78.4*14.9) **/ 16.5** = 131.30 (kN)

3. Calculate reaction of pin support at the point A:

$R_A = (q_1 * 19.3 * (16.5 - 19.3/2) + P_1 * \sin(63) * 10.3 + P_2 * 1.6)$ **/ 16.5** = (3.8*19.3*(16.5 - 19.3/2) + 52.6*sin(63)*10.3 + 78.4*1.6) **/ 16.5** = 67.31 (kN)

4. Solve this system of equations:
$H_A = P_1*\cos(63) = 52.60*0.4540 = 23.88$ (kN)

5. The sum of the forces about the Oy axis is zero:
$\Sigma F_y = 0$: $R_A - q_1*19.3 - P_1*\sin(63) - P_2 + R_B = 67.31*1 - 3.8*19.3 - 52.6*0.8910 - 78.4 + 131.30*1 = 0$

Vertical Reaction at A = 67.31 KN

Horizontal Reaction at A = 23.88 KN

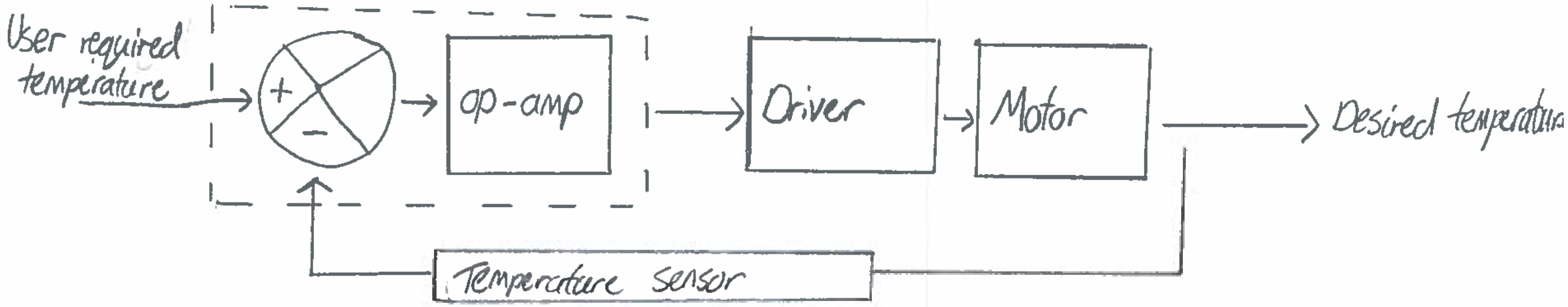
Vertical Reaction at B = 131.3 KN

Horizontal Reaction at B = Roller cannot take a horizontal force

Task Four

Ride queue AC system

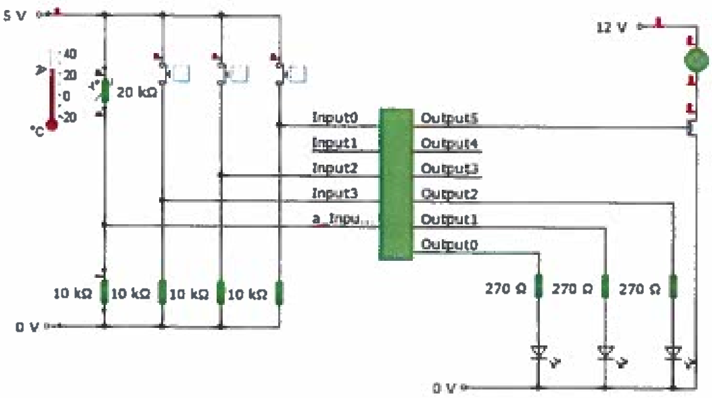
4)

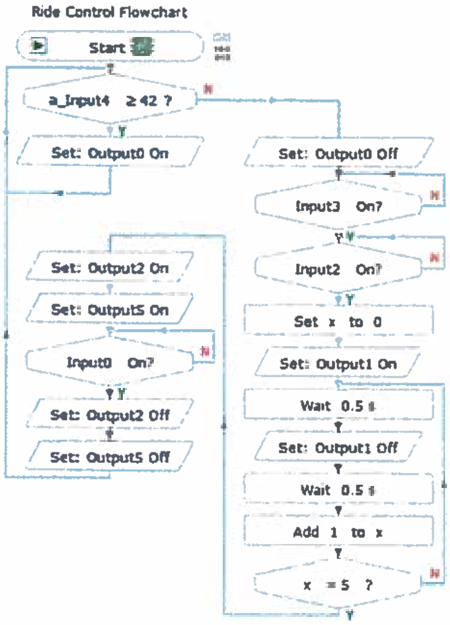


Task Five

Rollercoaster ride control

5)a)

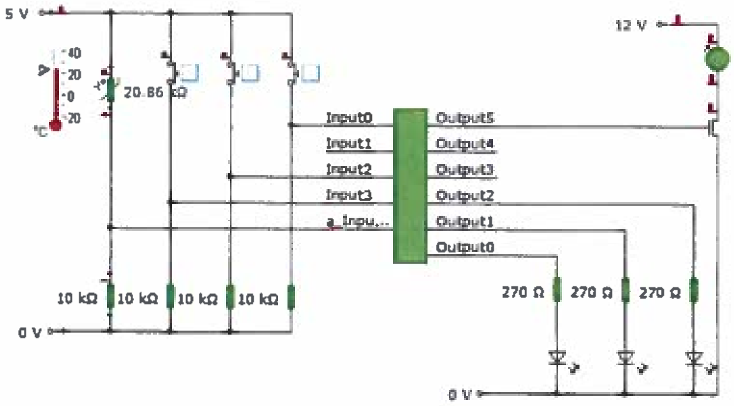


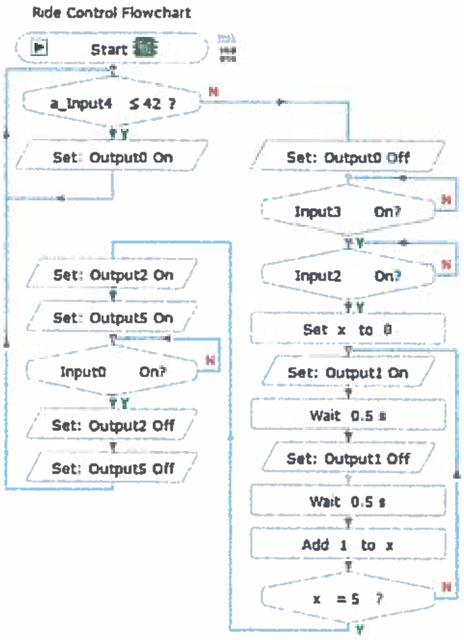


5)b)

Planned test	Expected result	Actual result	Amendments made
Adjust the thermistor temperature to its lowest value.	The 'temperature warning' indicator should be on.	The 'temperature warning' indicator turns off	When testing analogue input 4 the sign was changed to less than or equal to
Adjust the thermistor temperature to its highest value.	The 'temperature warning' indicator should switch off – the flowchart should progress to the next decision.	The 'temperature warning' indicator turns off and the flowchart progresses to the next step	None
Press the 'harness safety check complete' switch and the 'operator switch' in sequence.	The 'harness safety check complete' indicator should flash five times.	The 'harness safety check complete' indicator turns on once and then turns off five times	The loop was set to loop back to before output one is turned on as before the light was turning off five times instead of flashing

5)c)





5)d) The amended circuit meets the specification as once the temperature reaches around five degrees Celsius, a safe track temperature, which has a value *greater than* forty two the flowchart then progresses onto the next step. If it is *less than or equal* to forty two, five degrees or less, the temperature warning light then switches on. Once the 'harness safety check complete' and the operator switch have been pressed sequentially the roller-coaster is ready to start, this was met without any required amendments. The 'harness check complete' indicator then flashes five times by fixing the finite loop sequence after both the operator switch and 'harness safety check complete' switches have been pressed which is an effective safety feature to have as it leaves no risk of the operators forgetting to check the coaster harnesses as the ride cant actually start until this check has been completed. Once the ride has finished the operator can then press the 'ride end' switch which then restarts the flowchart.