

Engineering Science

PBasic & Systems

Revision

Name:-

Class Teacher:-

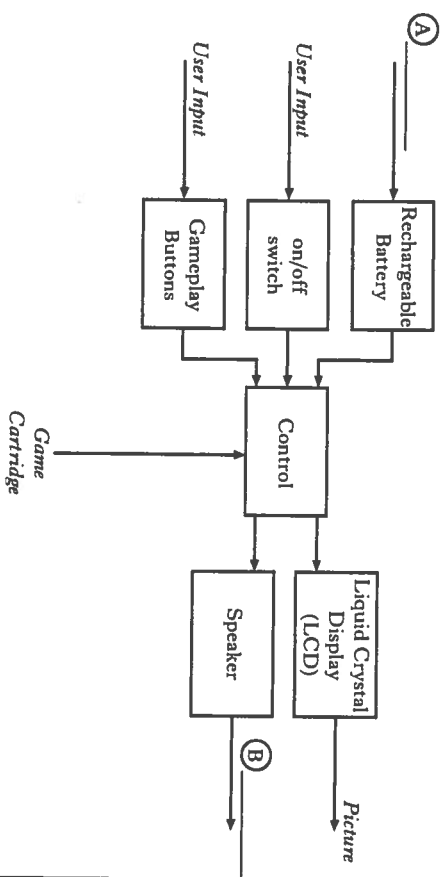
Date:-

1 A hand held games console is shown.



A simplified diagram of the main parts of the games console is shown below.

- (a) Complete the diagram by adding:
- (i) the missing input **(A)**;
 - (ii) output **(B)**;
 - (iii) the system boundary.



(b) The system consists of six parts shown above.

These parts of the system are called _____

[Turn over

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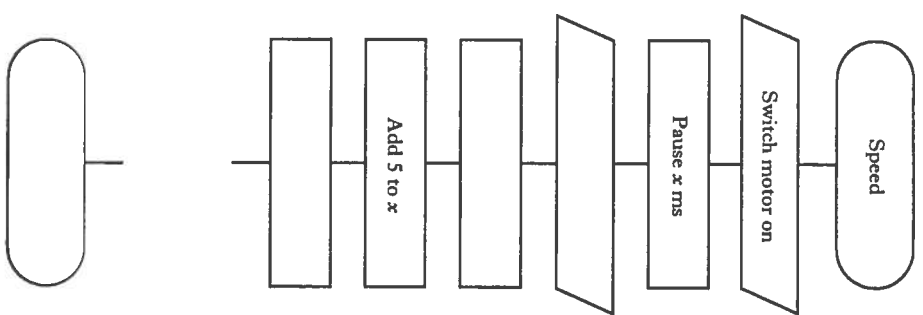
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1

1 0 1 0 1 0

8 (continued)

(c) Complete, with reference to the PBASIC "speed" sub-procedure and the Data Booklet, the flowchart below.



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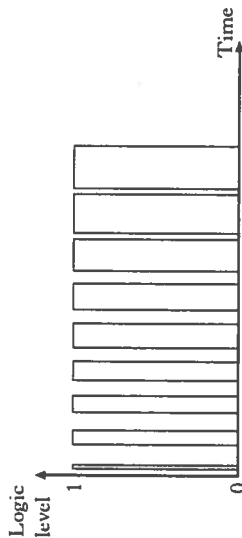
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6 5 4 3 2 1 0

- 8 A student is programming a microcontroller to start and slowly accelerate a motorised buggy. A graph showing the control required is given below.



- (a) State the name given to the programming technique where a motor is rapidly switched on and off.

(b) For the programming technique you named in (a):

- (i) state the name given to the time when the motor is switched on;
 (ii) state the name given to the time when the motor is switched off.

The student's initialisation and the PBASIC sub-procedure "speed", used to slowly accelerate the buggy, is shown below.

```

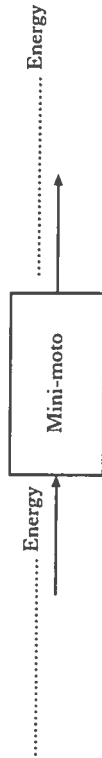
init:  symbol x = b0
       symbol y = b1
       symbol motor = 7
       let x = 0
       let y = 50

speed:  for b2 = 1 to 10
        high motor
        pause x
        low motor
        pause y
        let x = x + 5
        let y = y - 5
        next b2
    return
    return to main program
    
```

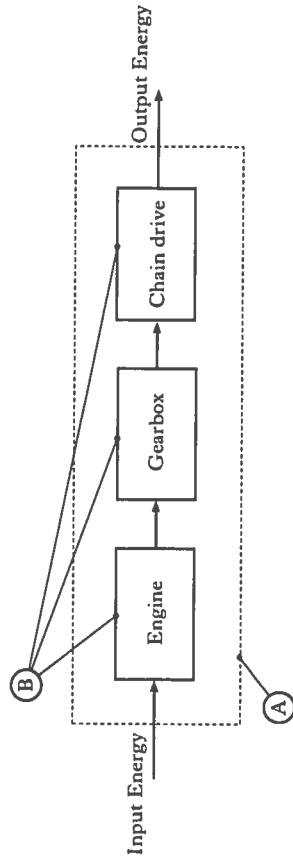
- 2 A petrol driven mini-moto is shown below.



- (a) Complete the system diagram below for the mini-moto by adding the main input energy and the main output energy.



- (b) The main parts of a mini-moto drive system are shown in the diagram below.



- (i) A separates the system from the outside world. State the name of this part of the diagram.

- (ii) The whole system can be broken down into several parts labelled above as B.

State the name given to these parts.

[Turn over

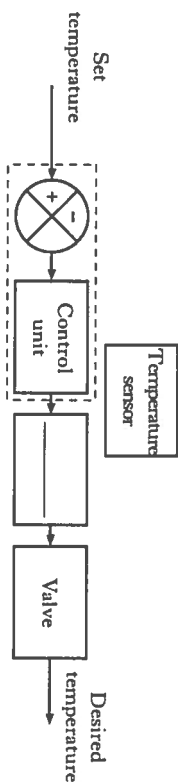
3 The temperature of a steam room in a leisure centre is controlled automatically.

A valve opens to release steam when the temperature is below the set level. When the temperature of the room is hot enough, the valve is closed.

(a) State the type of control produced by this automatic system.

1
0

(b) Complete the control diagram for this system.



2
1
0

(c) State the name of the control diagram symbol shown below.



1
0

7 (continued)

Input and output connections to the microcontroller are shown in the table below.

Input Connection	Pin	Output Connection
	7	Motor (1 = on, 0 = off)
	6	
	5	
	4	
	3	
	2	
Orange peel sensor (1 when peel is sensed, 0 when disposed)	1	
	0	Cleaning water (1 = on, 0 = off)

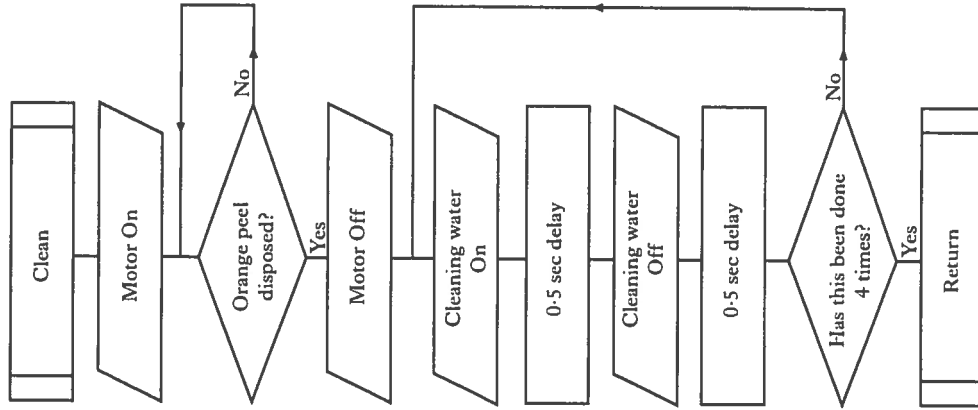
Write, with reference to the flowchart, Data Booklet, and the input/output table, the PBASIC control program for the sub-procedure, "Clean".

Clean:

8
7
6
5
4
3
2
1
0

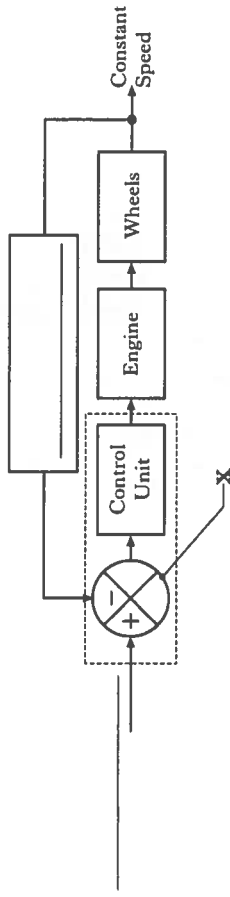
7 An automatic orange juicer is operated by a microcontroller.

The sequence of operations for the "Clean" sub-procedure is shown in the flowchart below.



4 A manufacturer wants to use a cruise control system to keep a car's speed constant even when it goes up and down hills. The system should allow a driver to take their foot off the accelerator once the desired speed has been set.

(a) Complete the control diagram below for the cruise control system.



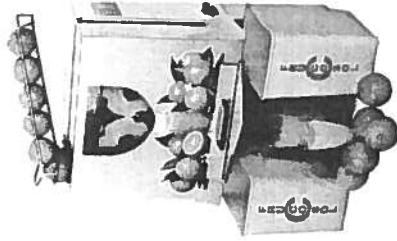
(b) State the name of the control diagram symbol X.

(c) This control system makes use of a feedback loop. State the type of control produced by this automatic system.

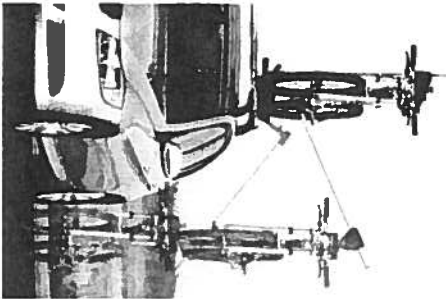
2
1
0

1
0

1
0



5 An automatic bicycle rack for a car is operated by a microcontroller.



- The sequence of operations for lowering a bicycle is listed below.
- The sequence begins with the lift arm motor off and locking solenoid on.
- When the 'down' switch is pressed the locking solenoid switches off then 10 seconds later the lift arm motor rotates forward.
- When the lift arm is in the fully lowered position a limit switch is activated which stops the motor.
- The sequence ends.

Input Connection	Pin	Output Connection
	7	
	6	
	5	
	4	
	3	Lift Arm Motor FORWARD
	2	Locking Solenoid
Limit Switch	1	
Down Switch	0	

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6 (continued)

The flowchart is used to develop a PBASIC program.

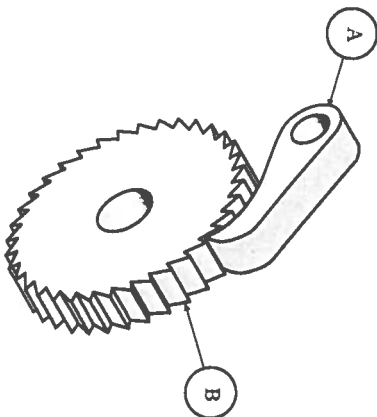
(b) With reference to the Data Booklet state the PBASIC command:

- (i) for pin 4, and 6 to be set up as an output and the remaining 6 pins set up as inputs;
- (ii) to produce a 5 second delay.

(c) State two advantages of using a microcontroller instead of a hard wired electronic system.

- 1 _____
- 2 _____

The device shown in the sketch below is part of the stadium roof mechanism.



(d) State the name of parts (A) and (B).

- (A) _____
- (B) _____

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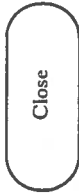
2 1 0

2 1 0

2 1 0

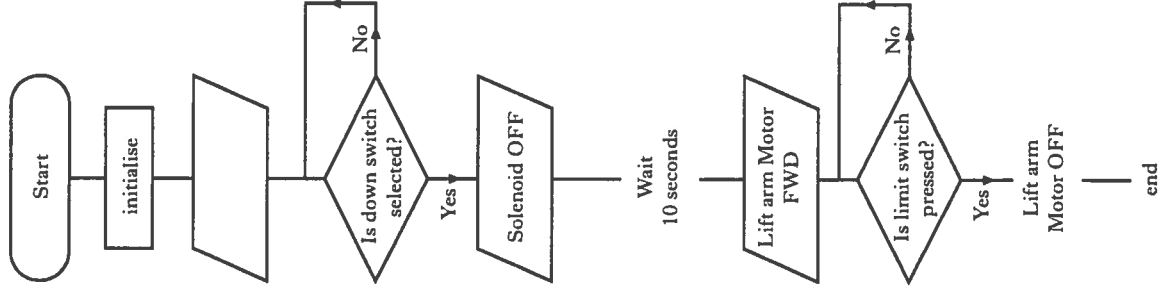
6 (continued)

(a) Complete, with reference to the sequence of operations and Data Booklet, the flowchart for sub-procedure 'close'.



5 (continued)

(a) Complete, with reference to the sequence of operations and Data Booklet, the flowchart by adding the correct symbols and instructions.



5 (continued)

(b) Complete, with reference to the microcontroller connections, Data Booklet and flowchart, the PBASIC program.

```

main:      let pins = %00000100
           if pin0 = 1 then label_1
           goto main
           'solenoid ON and motor OFF
           'test pin0

label_1:   pause 10000
           high 3
           'solenoid OFF
           '10 second delay
           'motor forward

label_2:   goto label_2
           'test pin 1

label_3:   low 3
           end
           'end program
    
```

(c) State two advantages of using a microcontroller instead of a hardwired electronic circuit.

- 1 _____
- 2 _____

(d) State the full name and function of the following microcontroller terms.

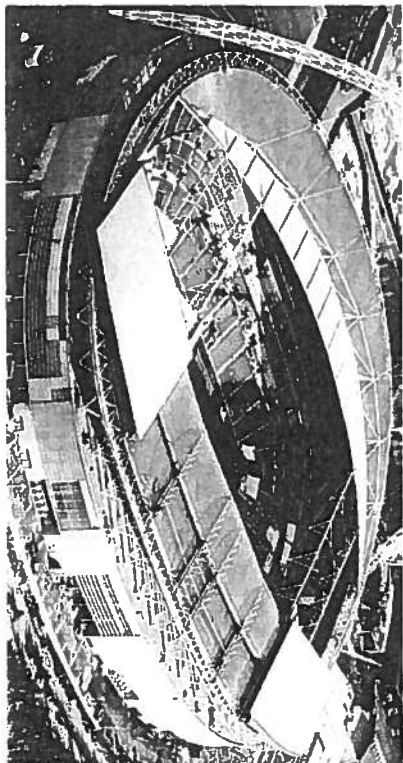
- (i) ROM
- Full name _____
- Function _____
- (ii) RAM
- Full name _____
- Function _____
- (iii) ALU
- Full name _____
- Function _____

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5 4 3 2 1 0

6 An automatic sliding roof for a sports stadium is operated by a microcontroller.



Part of the control program includes a sub-procedure 'close' which will run when frost is detected.

The sequence is as follows:

- the floodlights switch on;
- after a 5 second delay the roof motor switches on;
- when the stadium roof is fully closed a limit switch is activated which stops the motor;
- the sequence ends and returns to the main program.

INPUT/OUTPUT CONNECTIONS

Input Connection	Pin	Output Connection
	7	
	6	Roof motor
	5	
	4	Floodlights
	3	
	2	
	1	
Limit Switch	1	
	0	

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