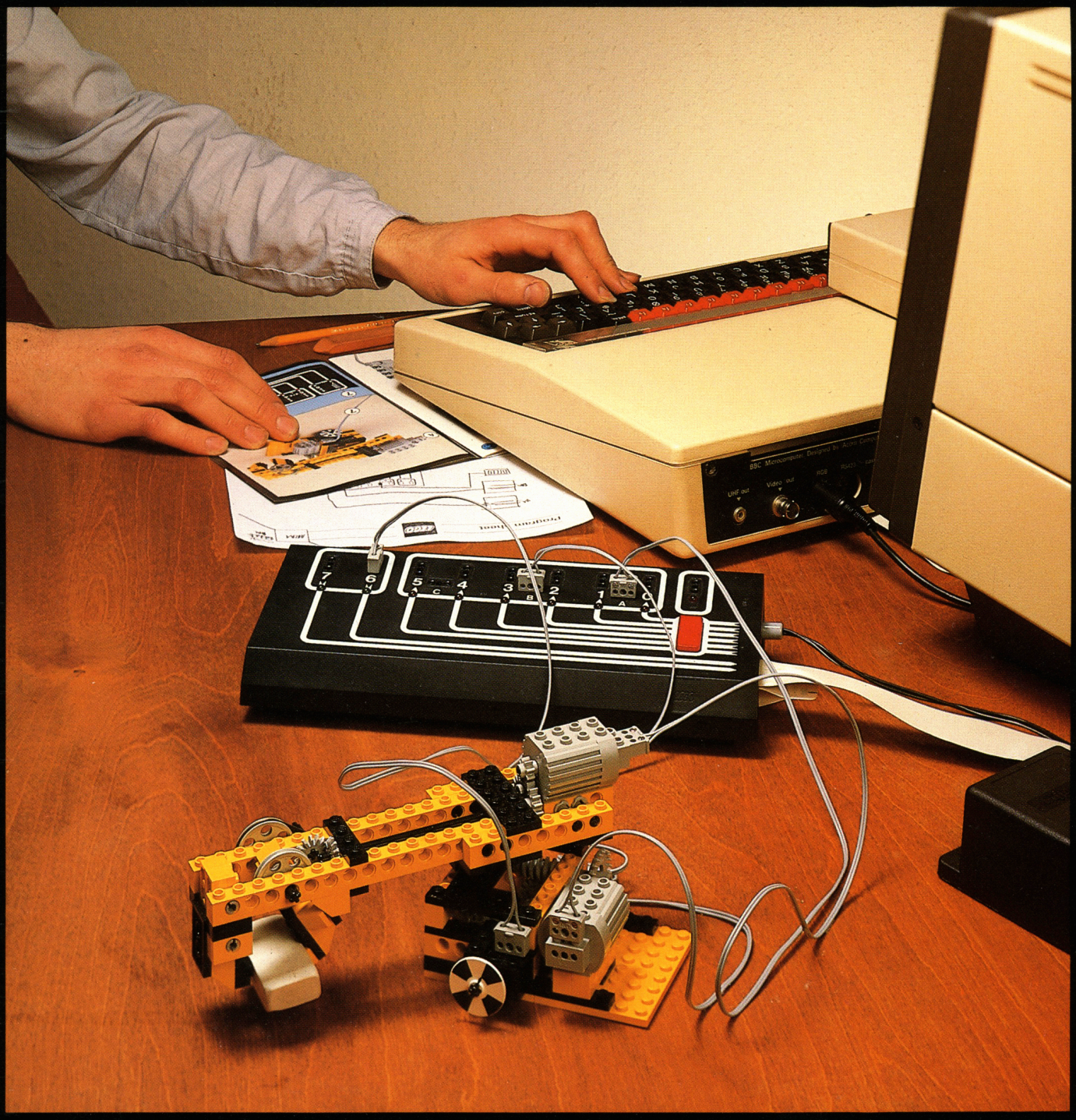
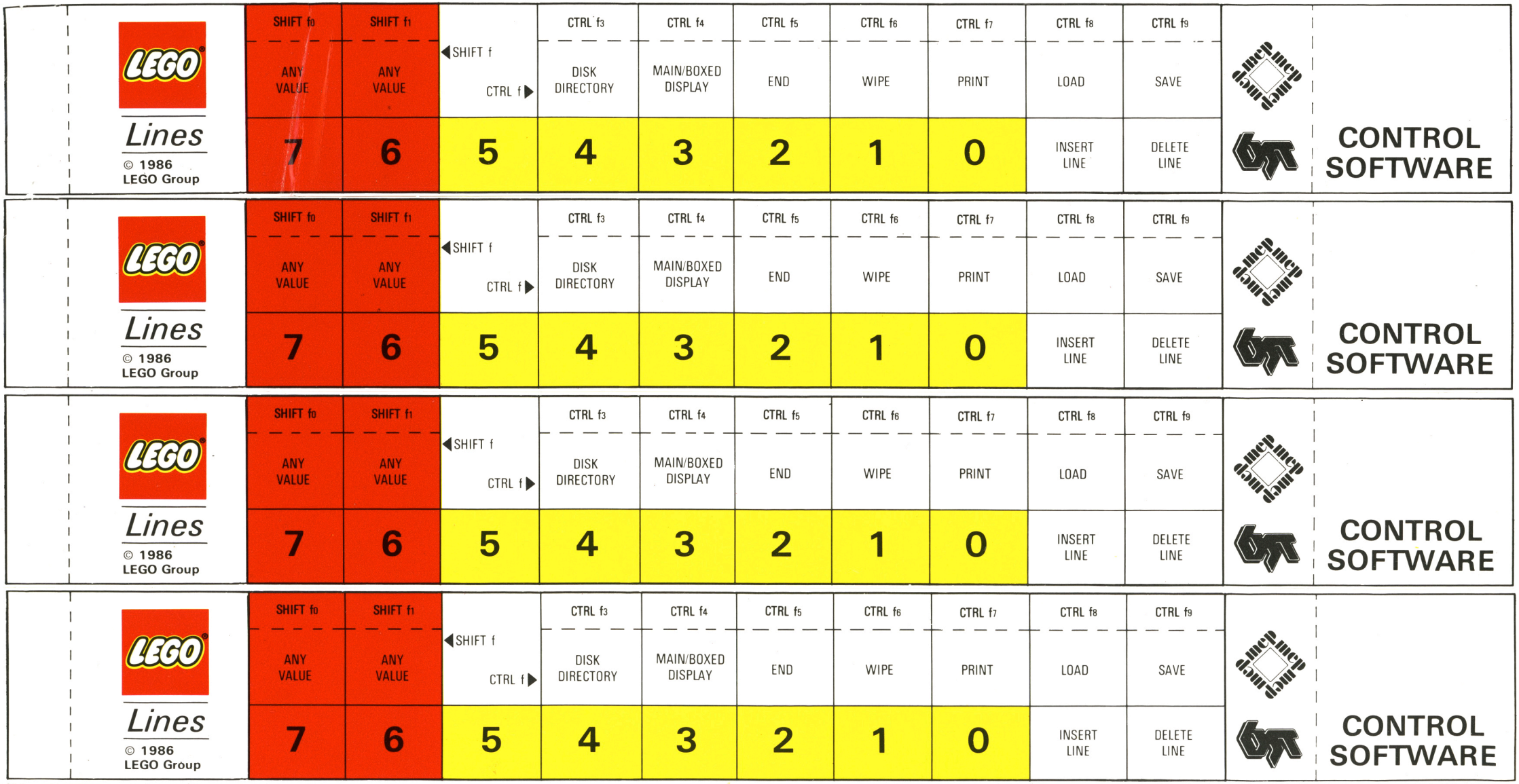
1455 Technic

LEGO

Programmable Systems

Classroom materials




SHIFT f0
SHIFT f1
SHIFT f
CTRL f
CTRL f3
CTRL f4
CTRL f5
CTRL f6
CTRL f7
CTRL f8
CTRL f9
ANY VALUE
ANY VALUE
DISK DIRECTORY
MAIN/BOXED DISPLAY
END
WIPE
PRINT
LOAD
SAVE
7
6
5
4
3
2
1
0
INSERT LINE
DELETE LINE
Lines
© 1986 LEGO Group
CONTROL SOFTWARE
BBC 'B' MICROCOMPUTER

Manual controller keystrip

c		b		a © 1986 LEGO Group	
5	4	3	2	1	0

c		b		a © 1986 LEGO Group	
5	4	3	2	1	0

c		b		a © 1986 LEGO Group	
5	4	3	2	1	0

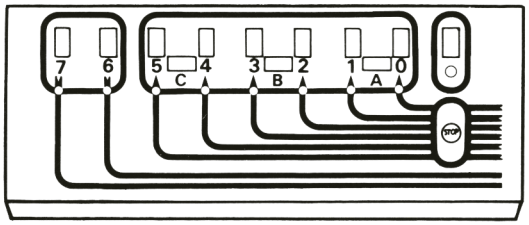
c		b		a © 1986 LEGO Group	
5	4	3	2	1	0

c		b		a © 1986 LEGO Group	
5	4	3	2	1	0

c		b		a © 1986 LEGO Group	
5	4	3	2	1	0

c		b		a © 1986 LEGO Group	
5	4	3	2	1	0

Program sheet



	IN		OUT						
	7	6	5	4	3	2	1	0	

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Assessment

a **Analysis**

Stating the problem accurately
Exploring the problem
Developing deeper understanding
Developing criteria

s **Finding and developing the best solution**

Evaluating each solution
Choosing the best solution
Modelling the best solutions

c **Communication**

Discussion with others
Listening to other's ideas
Drawing sketches and diagrams
Writing a report
Giving a talk

i **Finding and developing ideas**

Discussion with others
Looking and thinking up ideas
Investigating ideas
Finding several solutions

e **Evaluation**

Using the criteria to carry out tests
Analysing the tests' results
Making modifications when necessary

t **Teamwork**

Contributing ideas
Sharing work equally
Working cooperatively

Assignment	*Notes*

Assignment	*Notes*

Assignment	*Notes*

Assignment	*Notes*

Assignment	*Notes*

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Assignment: 0

Introduction to the materials

A0a

You will need

Resources booklet
Program sheet
Assessment sheet

You are going to

Learn how to use the materials

Using the materials you are going to learn about three different ways to control devices:

— human control
— mechanical control
— electronic control

To do this, you will be given Assignment cards, like this one. This assignment, Assignment 0, comes in three parts, A0a, A0b and A0c.

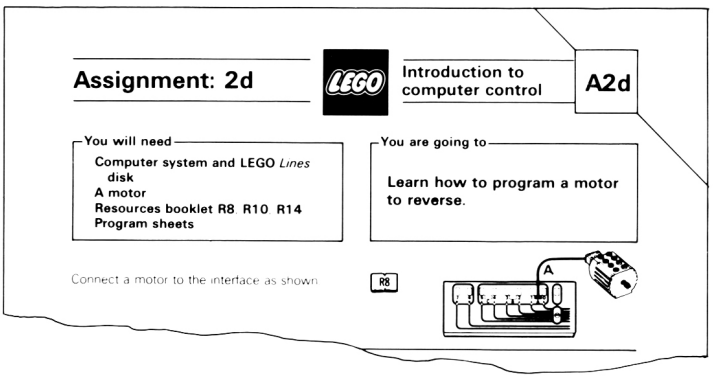
To help you in all the assignments, there are the Resources booklet, the Program sheet and the Assessment sheet. Make sure you have these in front of you for Assignment 0.

Assignment cards

The Assignment cards, like this one, are designed to be as easy to use as possible. On the top right-hand corner of each one you will find a reference number, A0a on this one (that is Assignment 0, part a). Underneath this you will find a statement of what you are going to do in the assignment.

The box on the top left-hand side of the card outlines what you will need in order to do the assignment. You should make sure you have these before you start.

The rest of the card tells you what to do. Drawings and sample programs take you through the activity. Where extra help is available in the Resources booklet, you are shown where to find it by the figure in the middle column like this: R8



Program sheet

Use resources page **R11** to discover what you will be writing in each of the columns.

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Assignment: 0

Introduction to the materials

A0a

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Program sheet
Assessment sheet

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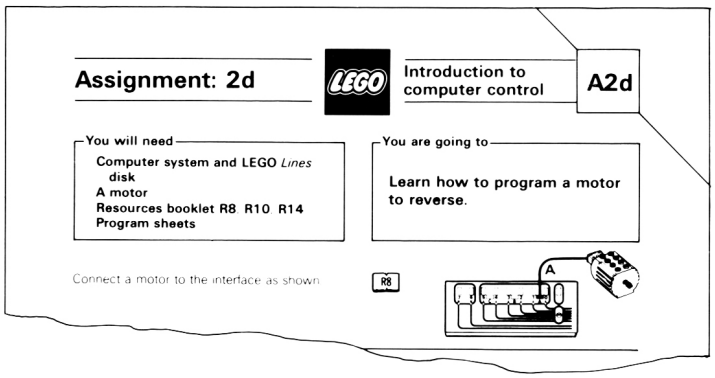

Program sheet

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Assignment: 0

Introduction to the materials

A0c

You will need

Assessment sheet
Resources booklet

You are going to

Learn how to use the Assessment sheet

Assessment sheet

This is to help you measure the success of what you are doing and of what you have learnt. At the top there are headings for you to use to describe how you have got on, next to boxes containing letters (these letters also appear on the bottom of every Assignment sheet). Help is available on these headings on the following Resources booklet pages:

R1 R2 R3 R4 R5

1 What does **i** stand for?

2 Where would you look to find out more about what **a i s e c** and **t** stand for?

3 What are *Criteria*?

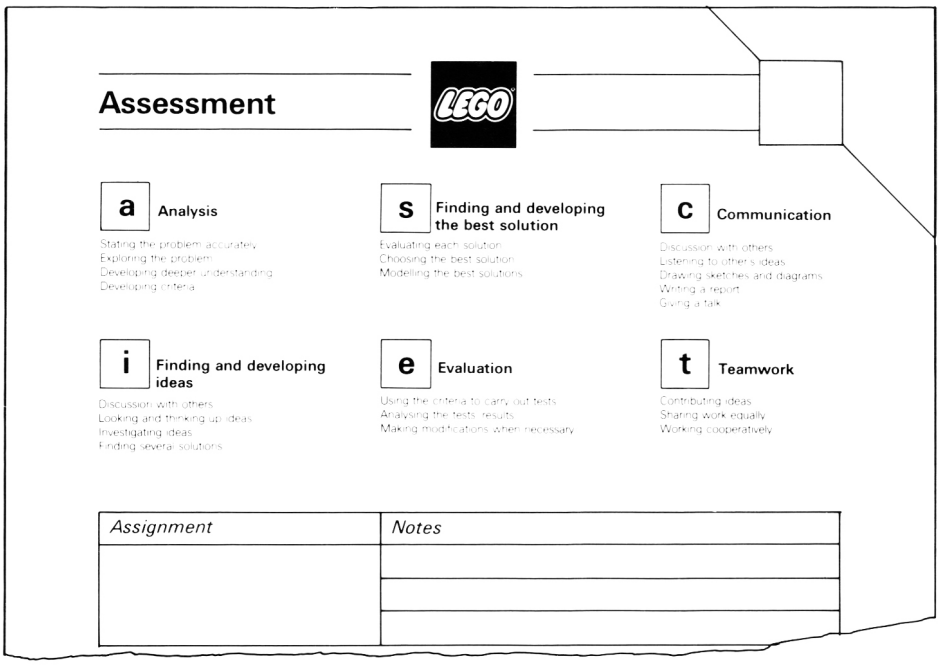
4 If you were asked how well you thought your group worked as a team, what questions would you ask yourself?

5 **c** has five elements in it. Which do you think will be the most difficult for you to achieve?

6 Do you think you will use all the items on the Assessment sheet in every single assignment you do?

7 Are there any terms you can't find out about on the Assessment sheet?

8 Fill in an Assessment sheet for Assignment 0, describing what you think you have learnt from answering these questions.



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Assignment: 1a

Introduction to programmable systems

A1a

You will need

Computer system with disk drive
LEGO *Lines* disk
1 motor model and light brick
Resource booklet

You are going to

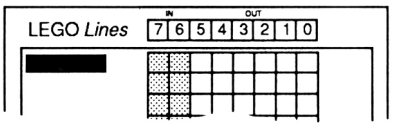
Use a computer program to control a model system.

Connect computer system and insert disk. R7

Collect model and connect it to the interface as directed in the Resources booklet. R8

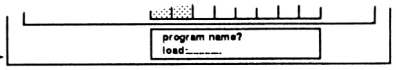
Loading LEGO *Lines*

Press **SHIFT BREAK** to autoboot LEGO *Lines* R10



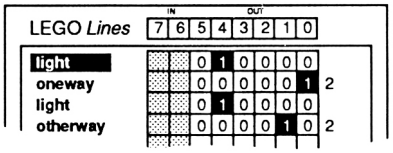
Loading a program

Press **CTRL f8** to load program — this message should appear →



Type **MLA** and then press **RETURN** to load program **MLA**.

This program is designed to turn a light on, rotate a motor one way for two seconds, turn the light on again and rotate the motor the other way for another two seconds.



Running the program

Press **TAB** to run the program — check that the system performs correctly. If not →

and then

Changing the program

R10

Alter the time of rotation

Press ↓ then → and check that the cursor block has moved down and across

Press **DELETE** to remove the time on this line:

Oneway ■ ■ Ø Ø Ø Ø Ø 1 2.0

Enter a number between 1.0 and 3.5. Check to see it is entered correctly.

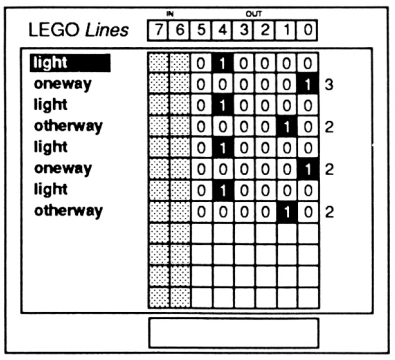
Press **TAB** to run the program. Then copy the program onto a Program sheet and describe what it does.

Enter more instructions to repeat the sequence

Press ↓ until the cursor block reaches the first blank line.

Copy the original instructions

Use: Letter keys for labels
Red keys for output values
Numbers for timing or counting
RETURN to go to the next line. R10



Press **TAB** to run program and then produce a printout of this 'new' program and describe what it does.

a i s e c t

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Assignment: 1b

Introduction to programmable systems

A1b

You will need

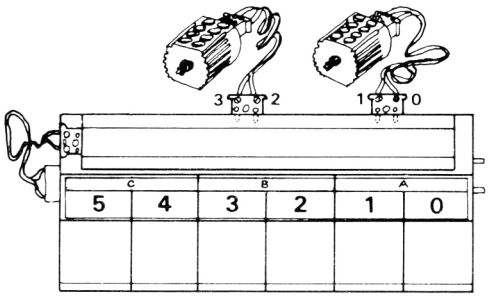
Manual controller and keystrip
Two-motor model (1090 D or 1090 E)
Resources booklet R6, R8
Program sheets

You are going to

Control a model using the manual controller.

Connect a two-motor model to the manual controller as shown in the Resources booklet.

R8



Press each key on the controller reasonably hard in turn.

Note what happens to the model.

A summary of your actions is given below:

The 1 means that key 1 is pressed or *on*

Draw this table and complete it.

	5	4	3	2	1	Ø
Key 0	Ø	Ø	Ø	Ø	Ø	1
Key 1	Ø	Ø	Ø	Ø	1	Ø
Key 2						
Key 3						
Key 4						
Key 5						

Try pressing keys 1 and 3 at the same time:

What happens to the model?

Why?

	5	4	3	2	1	Ø
Key 1 and Key 3	Ø	Ø	1	Ø	1	Ø

Check the direction the motors turn when you press keys 2 and Ø at the same time. If this is not the same, can you change the leads round so it is?

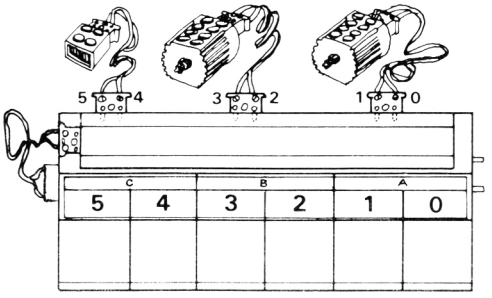
R8

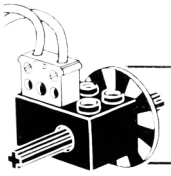
Here is a sequence of instructions.

	5	4	3	2	1	Ø	time
light on	Ø	1	Ø	Ø	Ø	Ø	5.0
one way	Ø	Ø	Ø	1	Ø	1	10.0
light on	Ø	1	Ø	Ø	Ø	Ø	5.0
other way	Ø	Ø	1	Ø	1	Ø	10.0

Instead of a key to press, we now have a ***label*** (to describe what is happening) and a time value to tell you how long to do it.

Now write some programs (on the program sheet) and try them out. Describe what you intend your models to do, and whether they do it.





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Assignment: 2a

Introduction to computer control

A2a

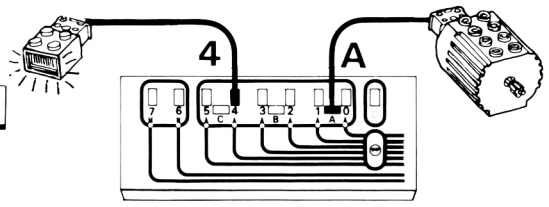
You will need

Computer system and LEGO *Lines* disk
A motor and a light brick
Resources booklet

You are going to

Learn how to control a motor and light brick.

Take a motor and a light brick from your model and connect them to the interface as shown.



R8

A washing machine manufacturer needs a control program which will spin clothes at the end of the wash cycle for 5 seconds.

The LEGO motor represents the washing machine motor.

R8

Possible solution

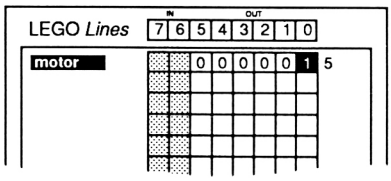
Press **SHIFT BREAK** to load LEGO *Lines*.

Press **CTRL** f8 to load program.

Type **ONE** press **RETURN** to load ONE.

Press **TAB** to test program and describe what this instruction does.

R10



An electric fan (*represented by the LEGO motor*) is required to come on for 8 seconds when a button is pressed.

Possible solution

Change time of last solution

→ to move cursor block to 'time'

Press **DELETE**

Press **8** to enter new time.

Press **TAB** to test program and describe what it does — look especially at the interface.

R10

An outside light is required to come on for 8 seconds when a button is pressed.

Possible solution

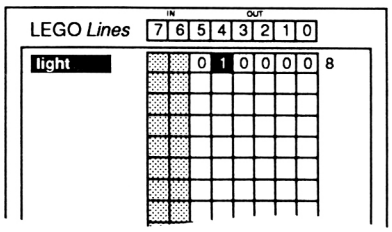
Press f7 to set bit 0 off.

Press f3 to set bit 4 on. (Look for a '1' in column 4).

DELETE label and enter another word to describe what is taking place.

Press **TAB** to test program and describe what it does.

R10



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Assignment: 2b

Introduction to computer control

A2b

You will need

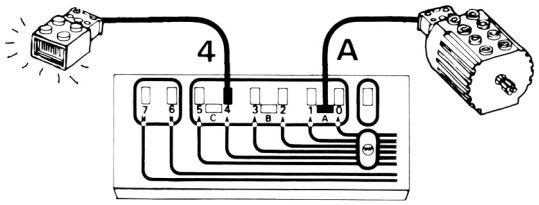
Computer system and LEGO *Lines* disk
A motor and two light bricks
Resources booklet R8, R10
Program sheets

You are going to

Learn how to control two or more output devices.

Use a light brick and a motor and connect them to the interface as shown.

R8



A program is required which operates a fairground ride (*represented by the LEGO motor*) and a light which shows that the ride is in progress for 5 seconds.

Possible solution

Connect motor to output bits A and lamp to output bits 4 on the interface.

R8

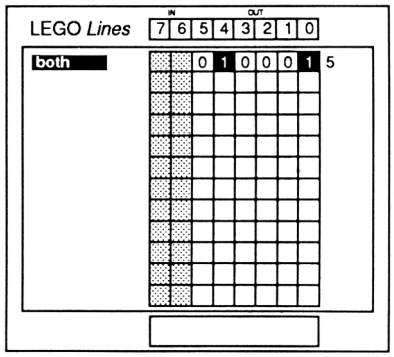
Press **CTRL** f_8 to load program.

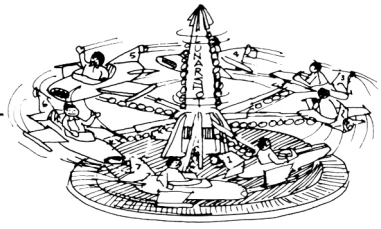
Type **TWO** press **RETURN** to load TWO.

Press **TAB** to test program.

R10

Describe what happens on screen, on the interface and to the motor and light.





Improve the fairground ride to include two lights.

Possible solution

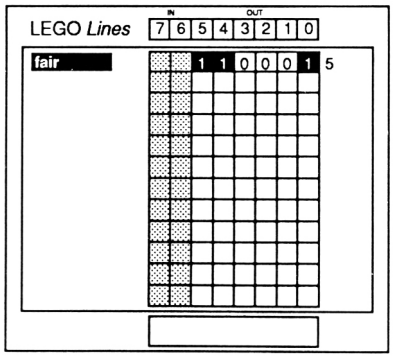
Connect another light brick to the interface.

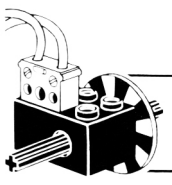
Change the line so that both the lights and the motor are on for 5 seconds.

Press **TAB** to test program.

R10

Make a record of your program on the Program sheet, obtain a printout of it (by pressing **CTRL** f_7) and describe how it solves the problem.





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Assignment: 2c

Introduction to computer control

A2c

You will need

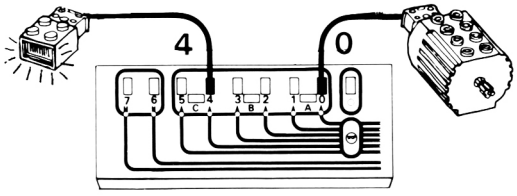
Computer system and LEGO *Lines* disk
A motor and two light bricks
Resources booklet R8, R10
Program sheets

You are going to

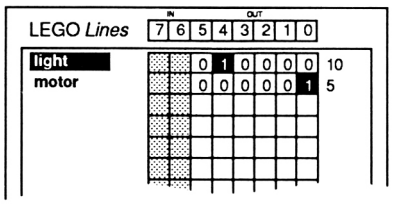
Learn how to program a sequence of instructions.

Connect the light brick and the motor to the interface as shown.

R8



A program is needed which will turn on a light 10 seconds before a motor is started up.



Possible solution

Connect motor to output bit 0.

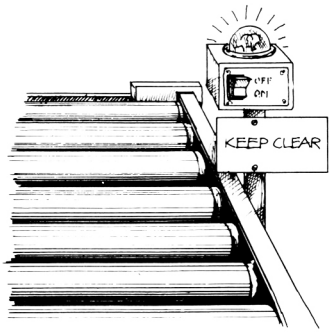
Connect lamp to output bit 4.

Press **CTRL** f8 to load a program.

Type **THREE** press **RETURN** to load program THREE.

Press **TAB** to test program and describe what happens.

R10



Modify the solution to turn on another lamp for 5 seconds after the motor has been turned off.

Possible solution

Connect another light brick to the interface.

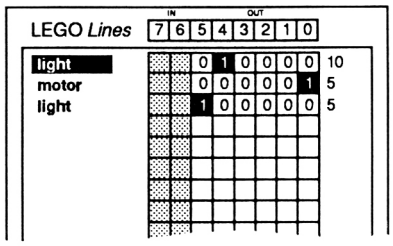
R8

Modify the program by adding an extra line.

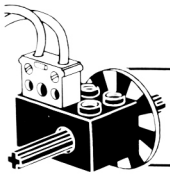
Position the cursor block at the start of this line and test it by pressing **COPY**.

Test the new program by pressing **TAB**.

R10



Make a record of your program on the Program sheet, obtain a printout of it (by pressing **CTRL** f7) and describe how it solves the problem.



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Assignment: 2d

Introduction to computer control

A2d

You will need

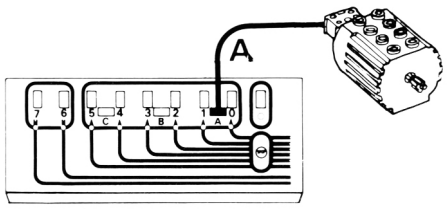
- **Computer system and LEGO *Lines* disk**
- **A motor**
- **Resources booklet R8, R10, R14**
- **Program sheets**

You are going to

Learn how to program a motor to reverse.

Connect a motor to the interface as shown.

R8



A program is needed to raise a barrier, pause and then lower the barrier again.

The solution should operate when a button (TAB) is pressed. The LEGO *motor represents the barrier motor.*

Possible solution

Press **CTRL** f8 to load program.

Type **FOUR** press **RETURN** to load FOUR.

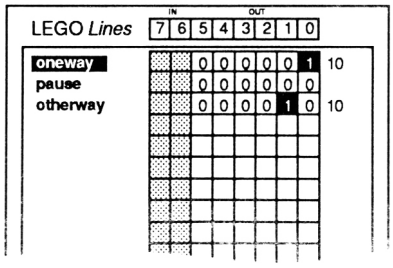
Press **TAB** to test program.

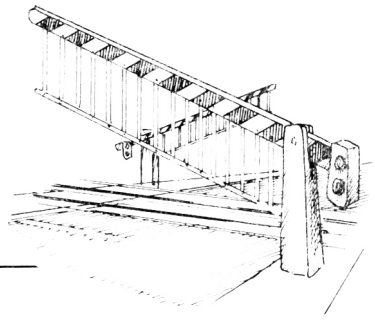
R10

Can you change the program so that the barriers pause for at least 15 seconds before starting again?

R14

Draw a structured flow diagram giving a solution to this problem and describe your solution.





Investigation

Change the last line of the program so that the output bits 0 and 1 are both on.

Press **COPY** to test new line.

R10

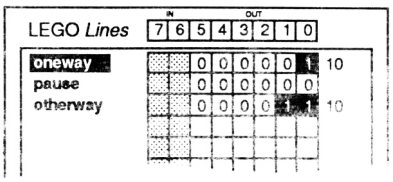
Explain what happens.

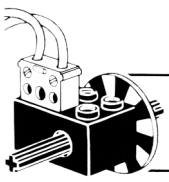
R19

Can you think of any everyday situations where this feature could be of any practical use?

R20

R21





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Assignment: 2e

Introduction to computer control

A2e

You will need

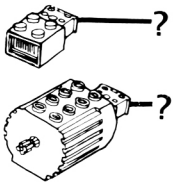
Computer system and LEGO *Lines* disk
A motor and two light bricks
Resources booklet R7, R8, R10, R11, R13
Program sheets

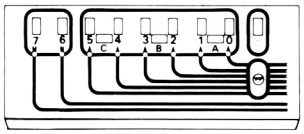
You are going to

Learn how to program a REPEAT FOREVER loop.

Use a motor and a light brick. You will have to work out from the programs where to connect them on the interface.

R8





A burglar alarm system requires a light which will flash on and of until a reset button is pressed.

Possble solution

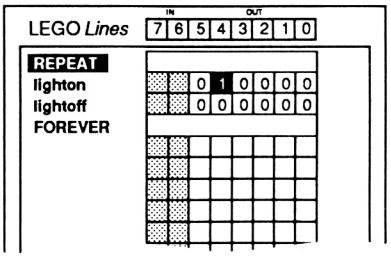
Press **CTRL** f8 to load program.

Type **FIVE** press **RETURN** to load FIVE.

Connect the light brick to the correct output, once you have loaded the program.

Press **TAB** to test program.

R10



Investigation

Press **SPACE** to halt program.

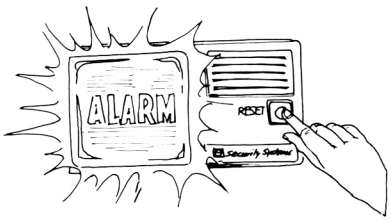
R10

Press **SPACE** to continue program.

Press **ESCAPE** to end program.

The **ESCAPE** key acts as a reset button. When you press it, the program stops and the light no longer flashes.

Copy the instructions onto a Program sheet and describe what is happening.



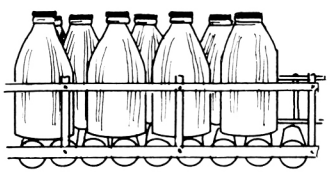
Design a program to control a machine which presses tops onto milk bottles as they move along a continuous conveyor belt.

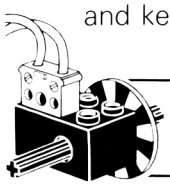
R13

What kind of device makes a conveyor move?
What kind of device can press a top onto a bottle?
How will the process of pressing the tops start and stop?

Use your answers to these questions to develop a solution to the problem using the LEGO materials.

Use the Program sheet to develop your solution and keep a record of your progress.





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Assignment: 2f

Introduction to computer control

A2f

You will need

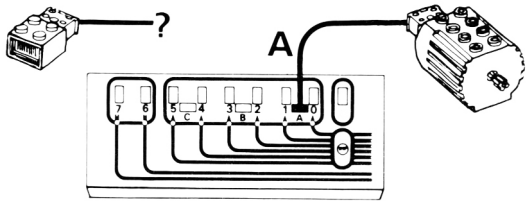
Computer system and LEGO *Lines* disk
A motor and two light bricks
Resources booklet R7, R8, R10, R11, R13
Program sheets

You are going to

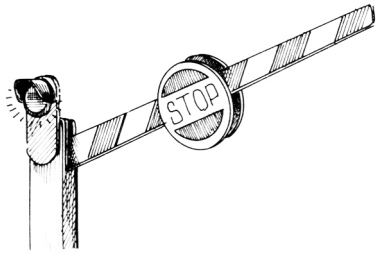
Learn how to program a REPEAT ENDREPEAT loop to run a set of instructions a number of times.

Use a motor and a light brick. Connect the motor to the interfaces as shown. You will have to work out from the programs where to connect the light brick.

R8



A level crossing barrier uses a flashing light to warn motorists it is closing. Design a program which will make this light flash 10 times.



Possble solution

Press **CTRL f8** to load program.

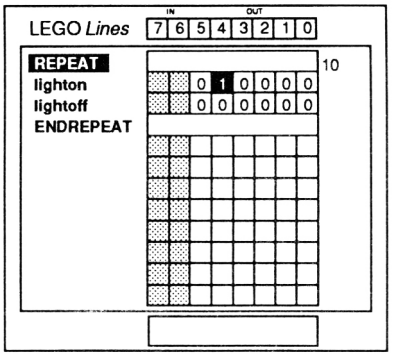
Type **SIX** press **RETURN** to load SIX.

Connect the light brick to the correct output, once you have loaded the program.

Press **TAB** to test program.

R10

Describe what happens in this program. How could the motor be included in this program?

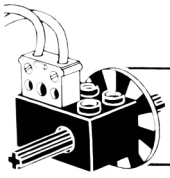


A washing machine manufacturer requires a control program which will rotate the drum one way for 10 seconds and then rotate it the opposite way for 10 seconds. This sequence needs to be repeated 4 times.

Using a light brick (*representing an on/off light*) and a LEGO motor (*representing the motor turning the drum*), write a program which solves this problem.

R13

Keep a record, on a Program sheet, of how your program develops.



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Assignment: 3

Introduction to manual control

A3

You will need

A model
A manual controller
Resources booklet R6, R16–21
Timing device (wristwatch)

You are going to

Learn how mechanical gears can control how quickly a motor turns a shaft.

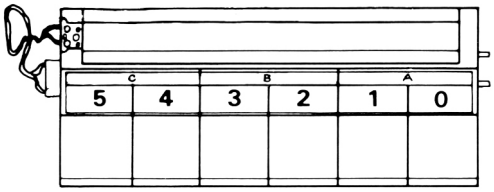
Connect the model to the manual controller.

R6

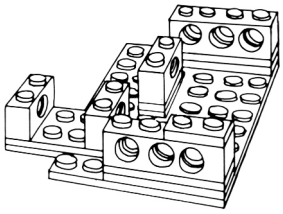
Make sure the connections are properly made.

Turn the motor on.

The model mechanism (the output shaft) turns more slowly than the motor which is driving it (the input shaft). Why should this happen?



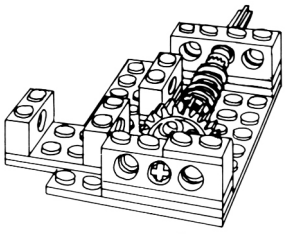
Build a gearbox like this one (you may need additional materials).

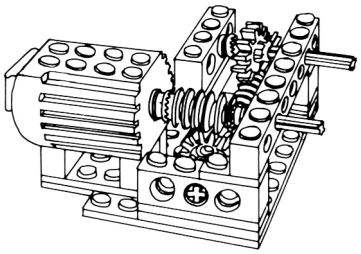


Why do the output shafts of this gearbox have different speeds to the motor?

R18

Discover if axles which turn quickly have a greater or smaller turning force than slower axles. Try slowing them down with your finger. Which is easier to stop?



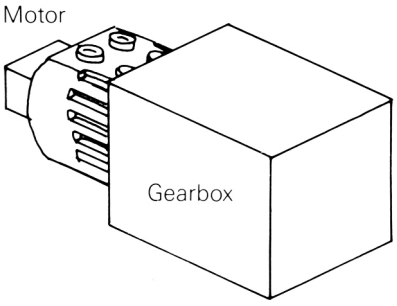


Look at the section in the Resources booklet on gearboxes and drive mechanisms.

R16

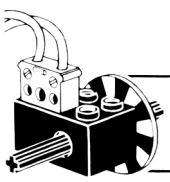
R18

How could you design a gearbox which will make your model move more slowly?



Use sketches and descriptions to record your ideas.

Build and test your design.



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Assignment: 4a

Sensing and feedback

A4a

You will need

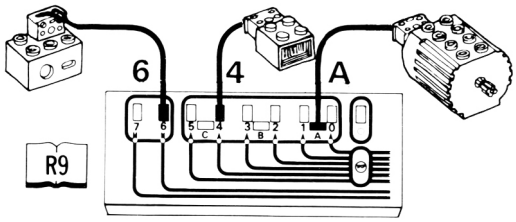
Computer system and LEGO *Lines* disk
A model with a light brick, a motor, and an opto-sensor brick
Resources booklet R7, R9–R12

You are going to

Learn how to use the opto-sensor brick.

Connect the motor on the model to output bits A.

Connect the light brick and opto-sensor to the interface as shown.

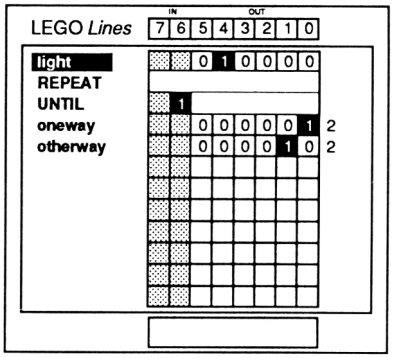


R9

On the interface bits 7 and 6 are input bits — that is, bits which let the computer system receive information from its environment.

Is the green indicator light for bit 6 on or off? Place your finger over the sensor slot — the indicator light will change. When you remove your finger it should return to its original state. Connect the opto-sensor to bit 7. Does it behave in the same way?

R10



Describe what you think is happening.

Reconnect the opto-sensor to bit 6 and connect it to your model. Connect the light brick to the model so that it shines into the opto-sensor, but 3 cms away from it.

Load the program called **MLB**. This program is designed to wait for a signal from the opto-sensor before switching the motor on for 2 seconds.

Press **TAB** to run the program and use your finger to trigger the sensor.

R9

Alter input sense

Pressing ↓↓ will take the cursor block down to the third line. Press **f1** to alter bit 6.

R11

Press **TAB** to run the program again.

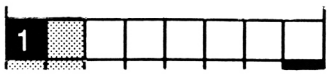
Can you explain why these two sets of instructions should behave differently?

Alter input line

Disconnect the opto-sensor from 6 and reconnect it to bit 7 on the interface.

Press ↓↓ and then press **SHIFT f1** to make bit 6 **any value**.

Press **f0** to alter the value of bit 7 to a 1 and press **TAB**.



▒ *in bit 6 means 'any value'.*

The sense of bit 6 will not matter when the **UNTIL** *looks for a signal.*

Counting input signals

Load and run a program called **COUNT**.

R10

This program waits for you to cover (and uncover) the sensor slot 10 times before continuing and turning the motor on.

Alter the program so that you only have to cover and uncover the slot 5 times before the motor is turned on.

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Assignment: 4b

Sensing and feedback

A4b

You will need

A model
Manual controller
Resources booklet R6, R12

You are going to

Learn about human sensing and feedback.

Part A

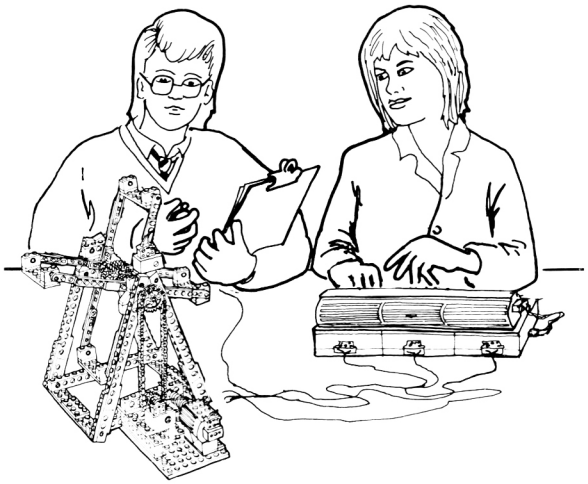
Decide on a task which fits your model (this should take about one minute to complete).

For example, use model 1090 A, the Ferris wheel.

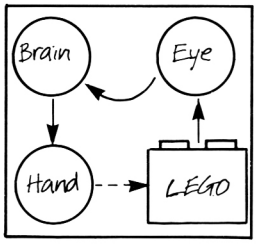
The task is to rotate the wheel so that each seat comes to rest at the bottom in turn so passengers can get on and off.

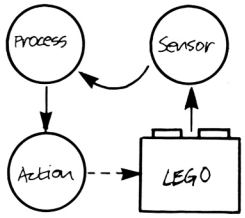
Use the manual controller and let each member of the group have a try. Make a note of the time it takes for each person to offload all the passengers.

Using the diagram, describe what is happening when a person performs this task (use the keywords ***sense***, ***process*** and ***act*** in your description).



R12





Part B

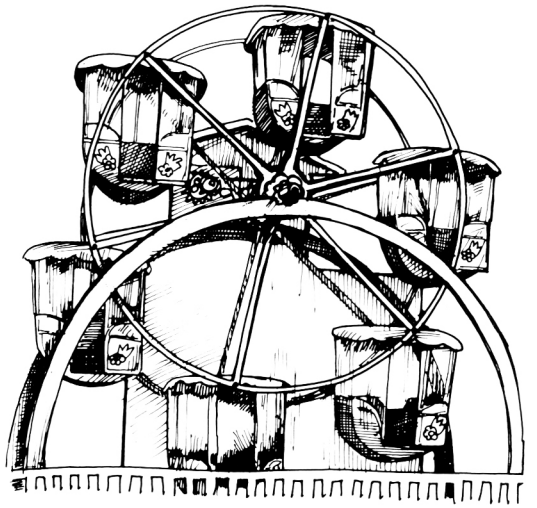
Whatever task you chose, you should now repeat it. This time, however, the person using the manual controller should have their eyes shut, so they cannot see the model.

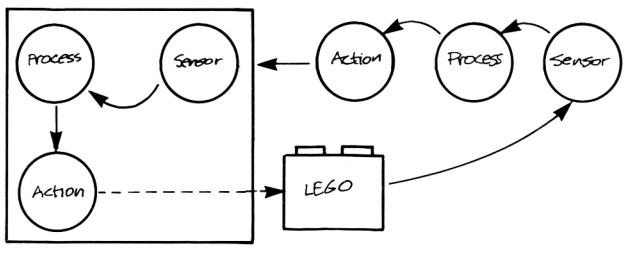
Another member of the group must now give instructions to the controller so the task can be performed. These might be 'Go forward', 'Back a bit' or 'Whoa!', whatever seems to work.

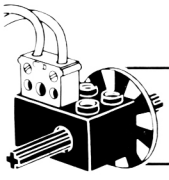
Again, you should make a note of the time it takes to complete the task.

How different were the times it took to complete the task?

Using the diagram, describe what happened (use the keyword ***feedback*** in your description). Try to explain why the tasks in part B took longer.







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Assignment: 5a

Computer control

A5a

You will need

Computer system and LEGO *Lines* disk
A motor, a light brick and an opto-sensor brick
Resources booklet R7–R10

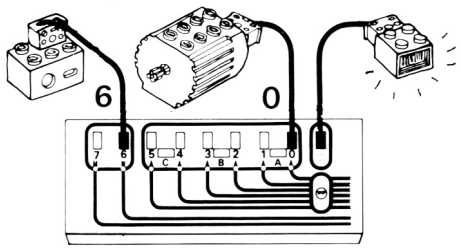
You are going to

Learn how to design a program which will REPEAT a sequence of instructions UNTIL an input message is sensed.

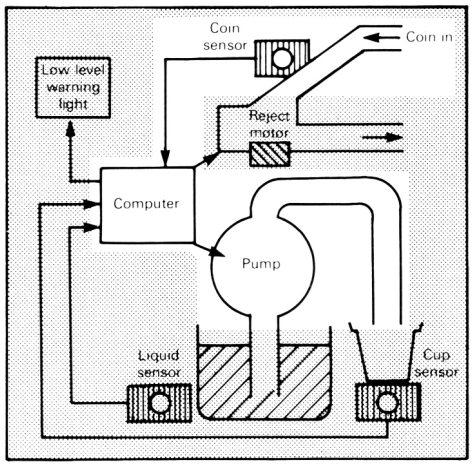
Connect the motor, the light brick and the opto-sensor brick to the interface as shown.

R8

R9



In a drinks dispensing system, a drink is to be pumped out only when a coin has been inserted. Design a program to solve this problem using the LEGO motor as the pump motor and the light brick and opto-sensor as a coin detector.



R9

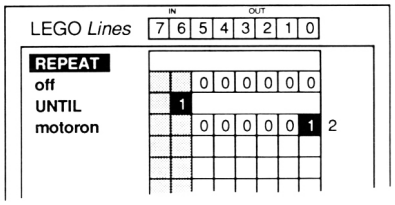
Check that the opto-sensor is connected to input bit 6.

R8

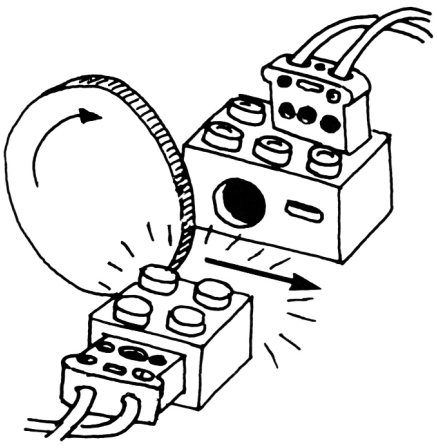
Connect a light brick to the 4 v output supply and arrange it so that when the light shines into the opto-sensor the indicator light for bit 6 is off.

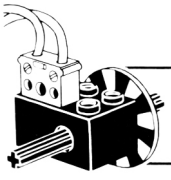
Load program **SEVEN**.

Press **TAB** to test the program. Cover the sensor to simulate a coin passing.



Use a hard copy of this program and describe what would happen in an actual drinks dispenser system once a coin had been detected.





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Assignment: 5b

Computer control

A5b

You will need

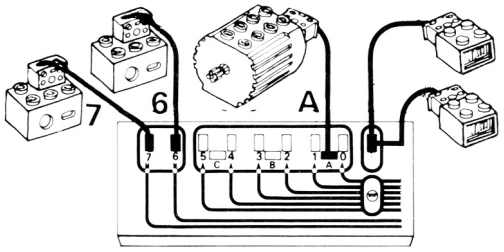
Computer system and LEGO *Lines* disk
A motor and two opto-sensor bricks and two light bricks
Resources booklet R7–R10

You are going to

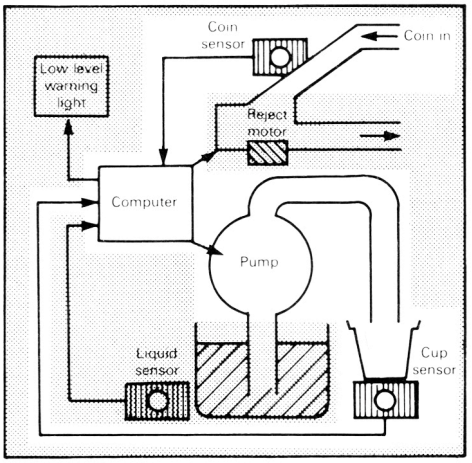
Learn how to design a program which requires two separate inputs to be sensed before an action is performed.

Connect the motor, the opto-sensors and the light bricks to the interface as shown.

R8-9



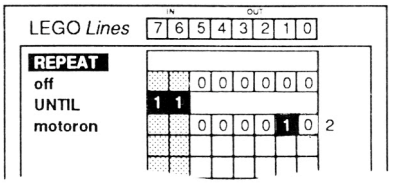
A program is required which will not dispense drinks until a coin is inserted *and* a cup is in place.



Connect the sensors to input bits 6 and 7. Make sure both indicator lights for bits 6 and 7 are off by placing your finger over the sensors as necessary, or by using the light brick as in **A5a**.

Connect the motor to output bits A.

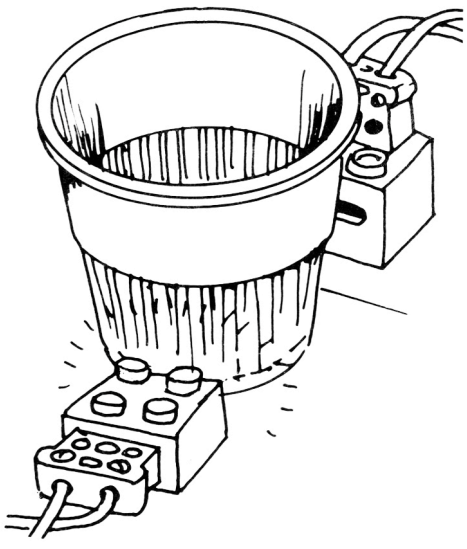
Load program **EIGHT**.

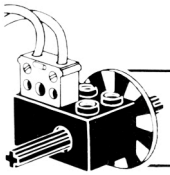


The opto-sensors are used to sense the presence of a coin and a cup.

Press **TAB** to test the program.

Use a hard copy of the program and describe what would happen in an actual drinks dispenser if the program were run.





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Assignment: 5c

Computer control

A5c

You will need

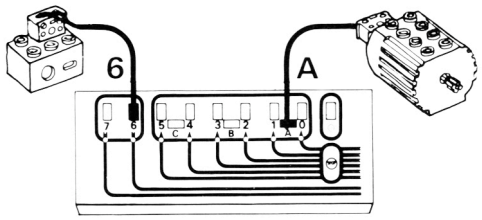
Computer system and LEGO *Lines* disk
A motor and an opto-sensor brick
Resources booklet R7–R10

You are going to

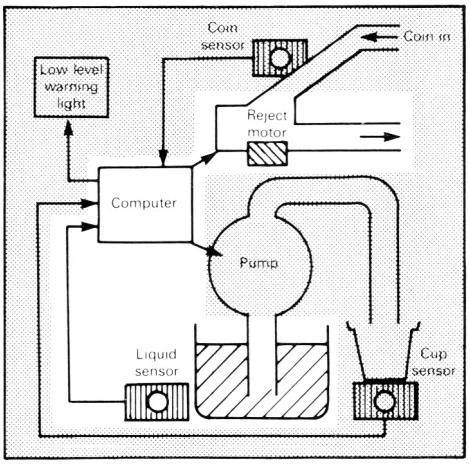
Learn how to design a program which will skip over a sequence of instructions until the right input is sensed.

Connect the motor and opto-sensor to the interface as shown.

R8-9



A program is required which will reject a coin if the liquid has been used up.



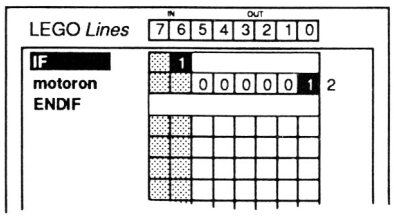
Condition the opto-sensor so that the indicator light on the interface is off at the start.

You could use a light brick (as before) or you could use your finger to activate the 'liquid sensor'.

The LEGO *motor represents the motor which rejects the coin.*

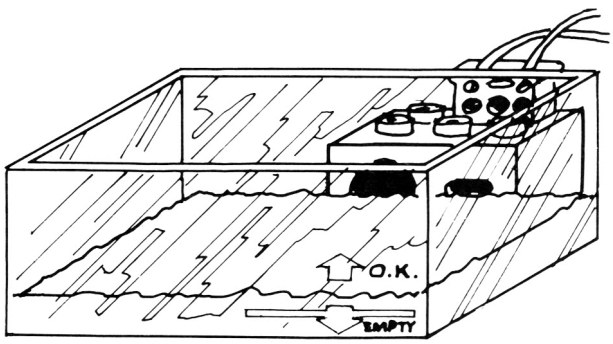
Load program **NINE**.

Press **TAB** to test the program.



Obtain a hard copy of the program and describe how it controls the motor.

Note that the motor does not come on (to reject the coin) until the sensor detects that the liquid has been used up.



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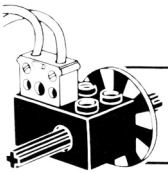


Assignment: 5d

Computer control

A5d

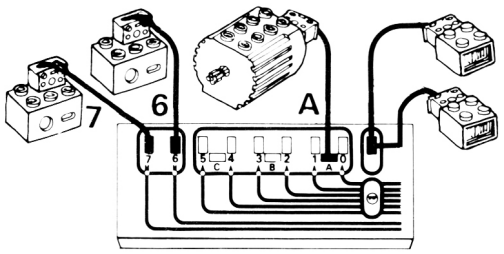
You will need

Computer system and LEGO *Lines* disk
A motor, two light bricks and two opto-sensor bricks
Resources booklet R7–R10

You are going to

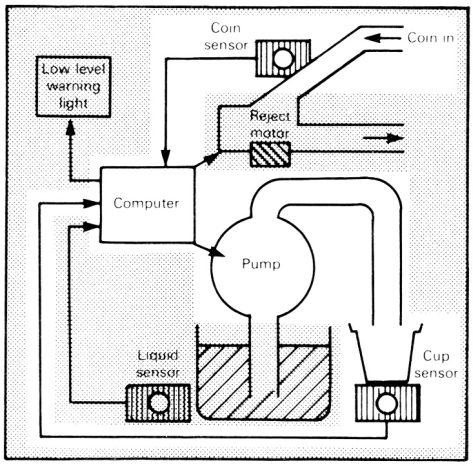
Learn how to design a program which will execute a sequence of instructions if two inputs are sensed.

Connect the light bricks, the motor and the opto-sensor bricks to the interface as shown.



A program is required which will only turn on the pump if a coin is inserted *and* a cup is in place.

Condition sensors so that the indicator lights on the interface are both off.

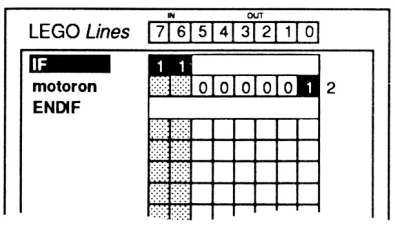


Load program **TEN**.

Press **TAB** to test program.

Describe what happens.

Can you account for why the program 'appears' not to work?

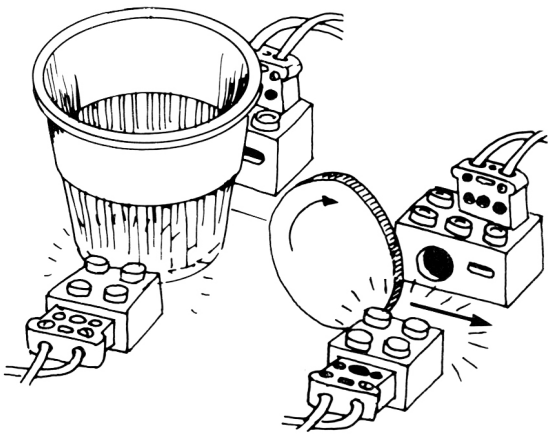


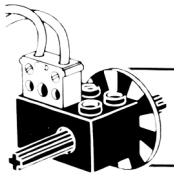
Note

The motor should ***not*** come on.

Condition the sensors so that the motor does come on.

Describe how you did this.





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Assignment: 5e

Computer control

A5e

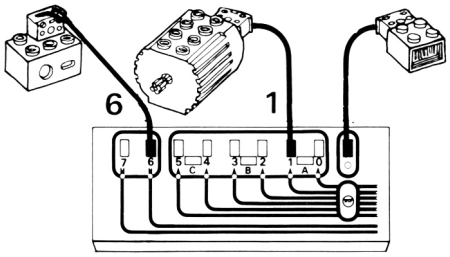
You will need

Computer system and LEGO *Lines* disk
A motor, a light brick and an opto-sensor brick
Resources booklet R7–R10

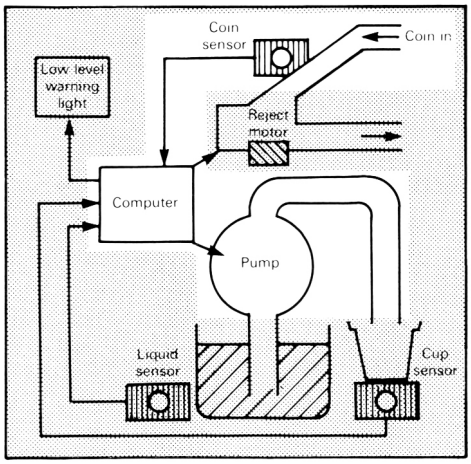
You are going to

Learn how to design a program which continually looks for an input and, when that input is sensed, executes a sequence of instructions.

Connect the motor, light brick and opto-sensor brick to the interface as shown.



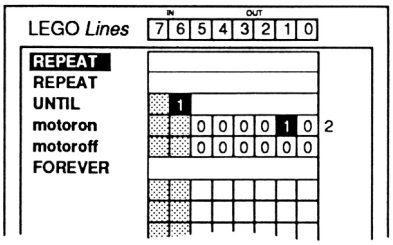
A program is required which continually looks for a coin and dispenses a drink when the coin is inserted.



Condition the sensor so that the indicator light on the interface is off.

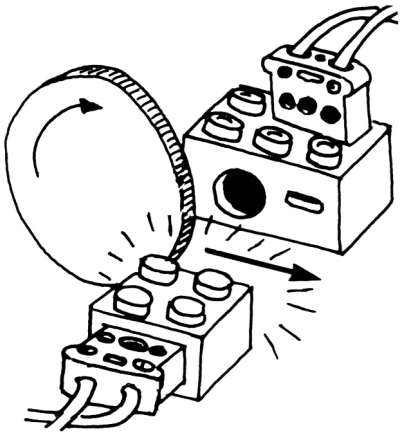
Load program **ELEVEN**.

Press **TAB** to test the program.

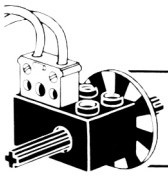


When you condition the sensor to be on, the program will turn the motor on, then off. You can condition the sensor to be off again to simulate waiting for a coin to be inserted.

This will be repeated until the **ESCAPE** key is pressed.



Copy this program onto a Program sheet and explain how it differs from previous examples in this assignment.



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Assignment: 5f

Computer control

A5f

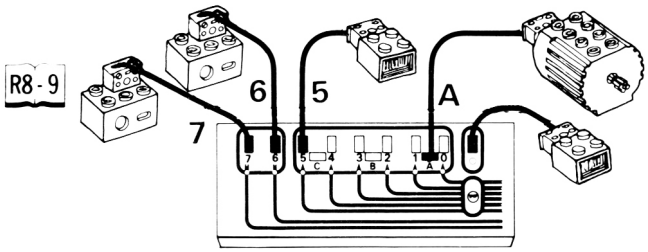
You will need

Computer system and LEGO *Lines* disk
A motor, two light bricks and two opto-sensor bricks
Resources booklet R7–R10

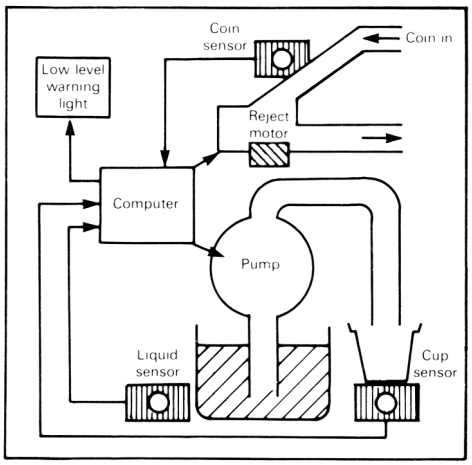
You are going to

Learn how to design a program which executes a sequence of instructions when an input is sensed. As part of those instructions another input will be tested and, if it is on, the appropriate action will be performed.

Connect the motor, light bricks and opto-sensor bricks to the interface as shown.



A program is required which looks for a coin and dispenses a drink when the coin is inserted. The program should then check the liquid level and, if it is too low, a warning light should be lit.

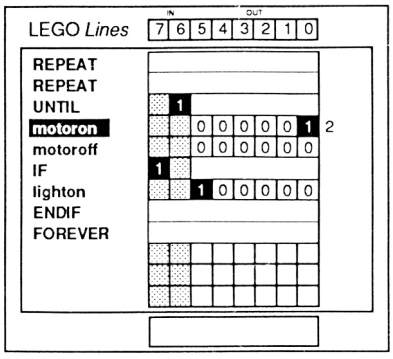


Condition the opto-sensors to be off.

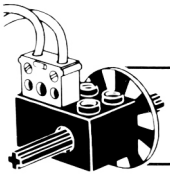
Load program **TWELVE**.

Press **TAB** to run the program.

ESCAPE will stop the program.



Copy this program onto a Program sheet and describe what would happen in an actual drinks dispenser if it were run.



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Assignment: 6

Manual control

A6

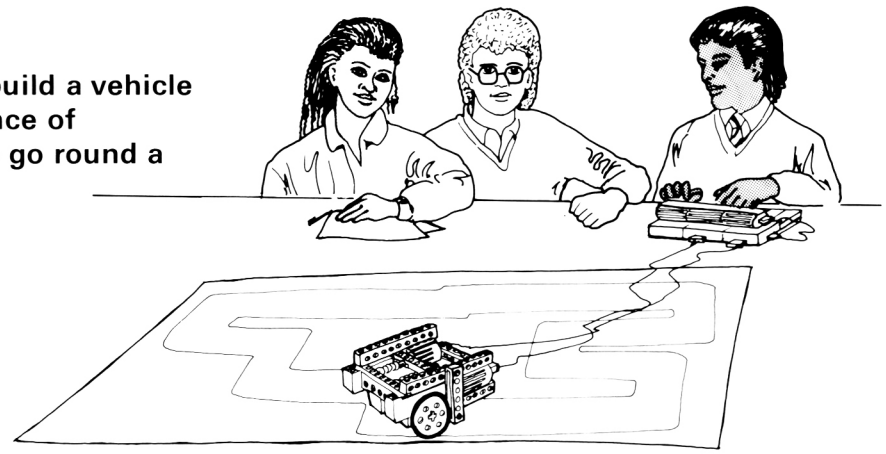
You will need

LEGO 1090 Kit
Manual controller
Resources booklet R6, R15–21
A1 sheet of paper

You are going to

Design and make a vehicle which you can then control.

Your group is required to build a vehicle and then to write a sequence of instructions to enable it to go round a course.



Building the vehicle

R15 shows some vehicle structures

R16 shows some drive mechanisms

R17 shows some steering mechanisms

Using these ideas, and ideas of your own, build the vehicle.

Draw a route

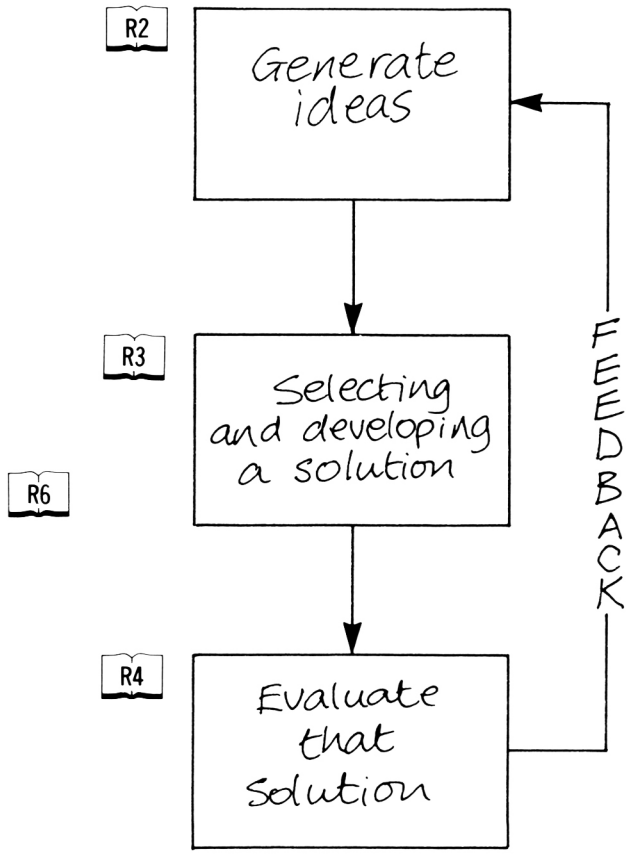
On the large piece of paper, draw a course for your vehicle to go round.

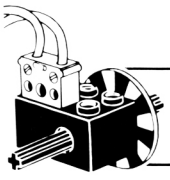
Test your model

Using the manual controller, test whether your vehicle is capable of going round at least part of the course. if it isn't, you will have to change your design until it can. This is the *feedback* part of the design process.

Write a program

Using a Program sheet, write a sequence of instructions which would let somebody else (from another group) make your vehicle follow the course you have drawn.





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Assignment: 7

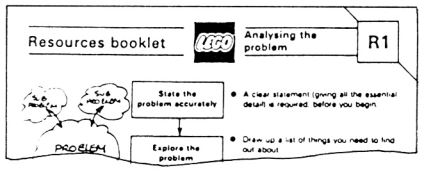
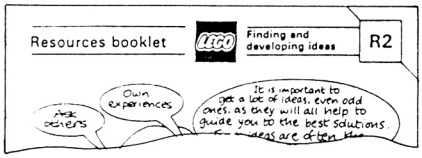
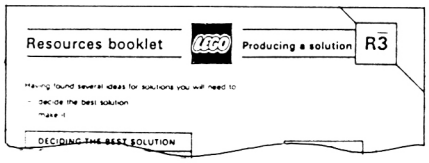
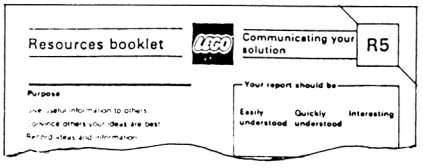
Solving a problem

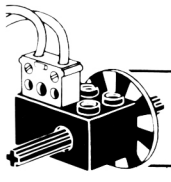
A7

You will need

Resources booklet
Your results from Assignment 6.

This is a model which will help you solve a problem.

Actions	*Outcomes*	*Further explanations in*
Analyse the problem	Criteria list	 **Analysing the problem**
Finding ideas	Several ideas	 **Finding and developing ideas**
Select and develop the best solution	working solution	 **Producing a solution**
Evaluate your solution	test results	**Evaluating the solution**
Communicate your work	a report	 **Communicating a solution**



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Assignment: 8

Designing a structured program

A8

You will need

A washing machine model 1090 C
Computer system and LEGO *Lines* disk
Resources booklet R1–R5, R10–R14

You are going to

Use the problem-solving process to produce a structured program in order to control a washing machine.

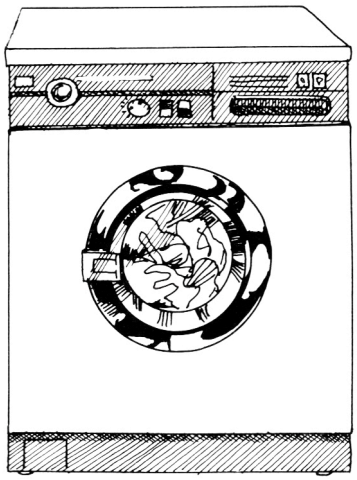
Problem solving

A program is required which turns the motor and the indicator light of a washing machine on when the door is closed and the switch is on.

The washing machine should turn off when the door is opened.

Resources available

The Assignments you have already completed
Resources booklet



Further problems

Turn the washing machine on if the door is closed and the switch is on. First execute a wash cycle (and light) and then spin (and light).

Add an emergency switch facility which shuts the machine off.

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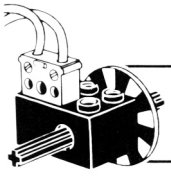

Assignment: 9a

Designing a programmed system

A9a

You will need

1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed

You are going to

Use the problem-solving process.

Sliding Door

A supermarket requires a sliding door system which will allow customers to pass in and out with ease but which remains shut at other times to save heat and energy.

As a development team for *HyperDoor (Electronic Doors) plc* your job is to prepare a report and demonstrate a solution to this problem.

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Assignment: 9b

Designing a programmed system

A9b

You will need

1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Ideas booklet
Assignments you have completed

You are going to

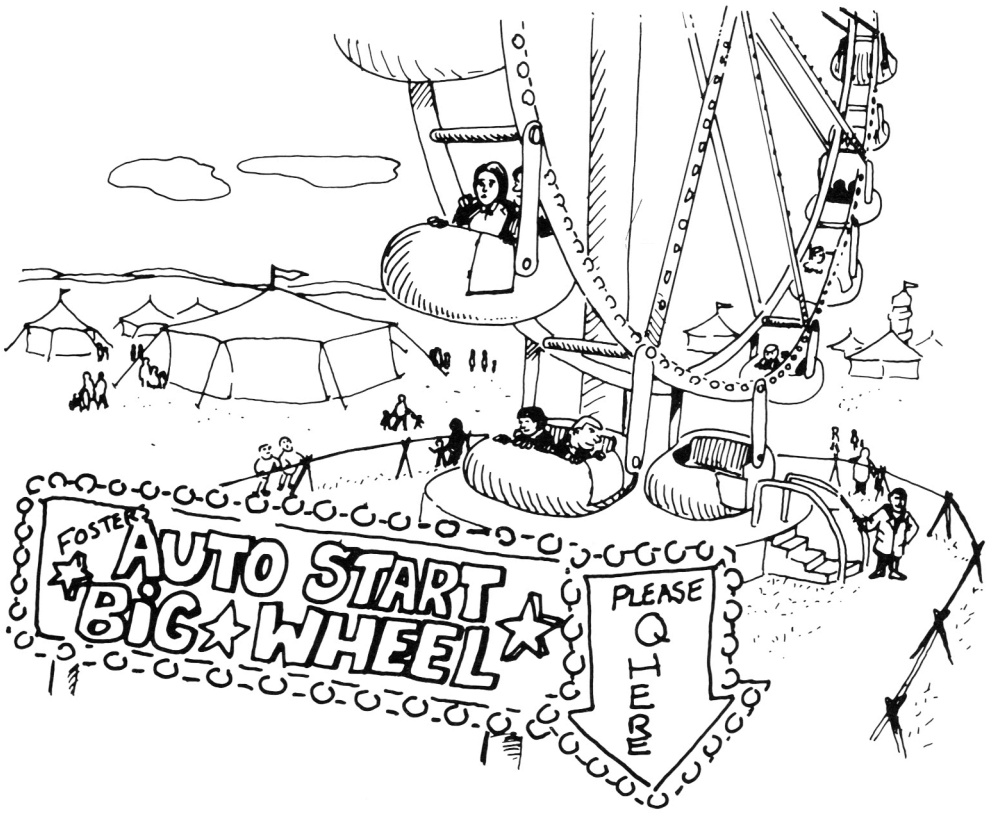
Use the problem-solving process.

Automatic Ferris wheel

A fairground equipment manufacturer has provided your design team with a contract to develop an automatic system for controlling a Ferris wheel ride.

The ride should be safer, more economic and more appealing than the present manual system.

You are required to provide a report and demonstration of a model of your best solution.



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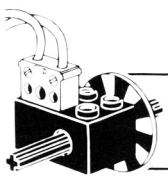


Assignment: 9c

Designing a programmed system

A9c

You will need

1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed

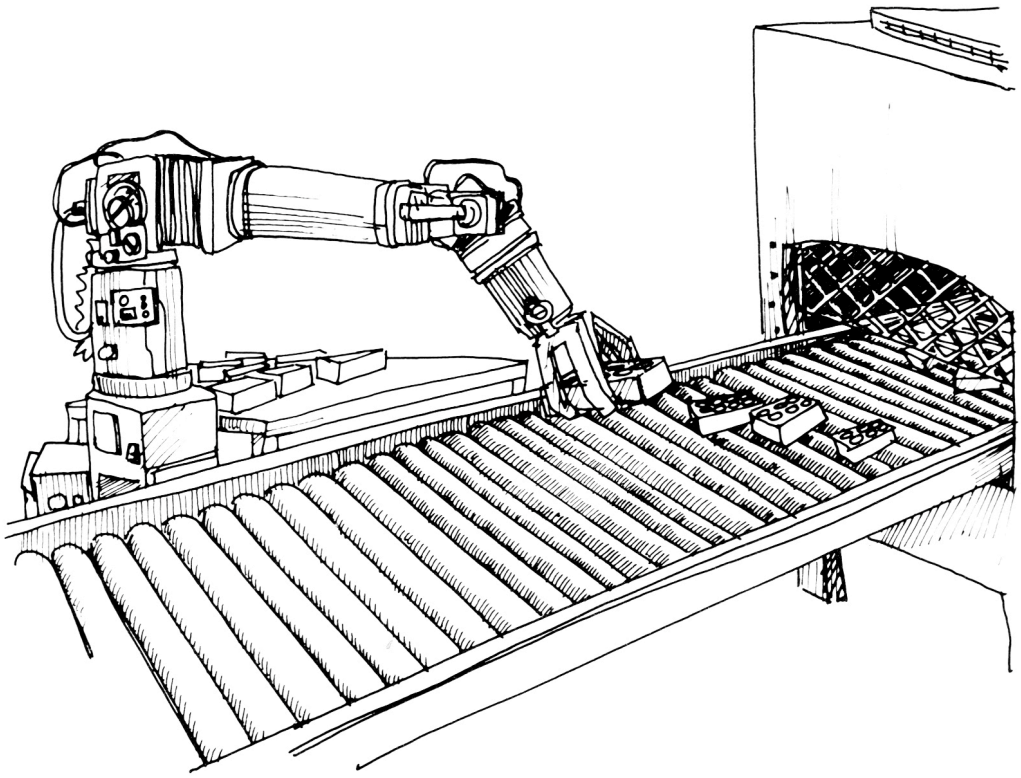
You are going to

Use the problem-solving process.

Robot Arm

A manufacturer requires a device which will pick LEGO bricks up from a conveyor belt and place them on a platform situated 10 cms from the conveyor.

Your team must provide a report and a model of this device.



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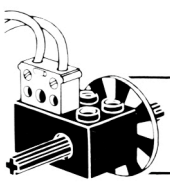


Assignment: 9d

Designing a programmed system

A9d

You will need

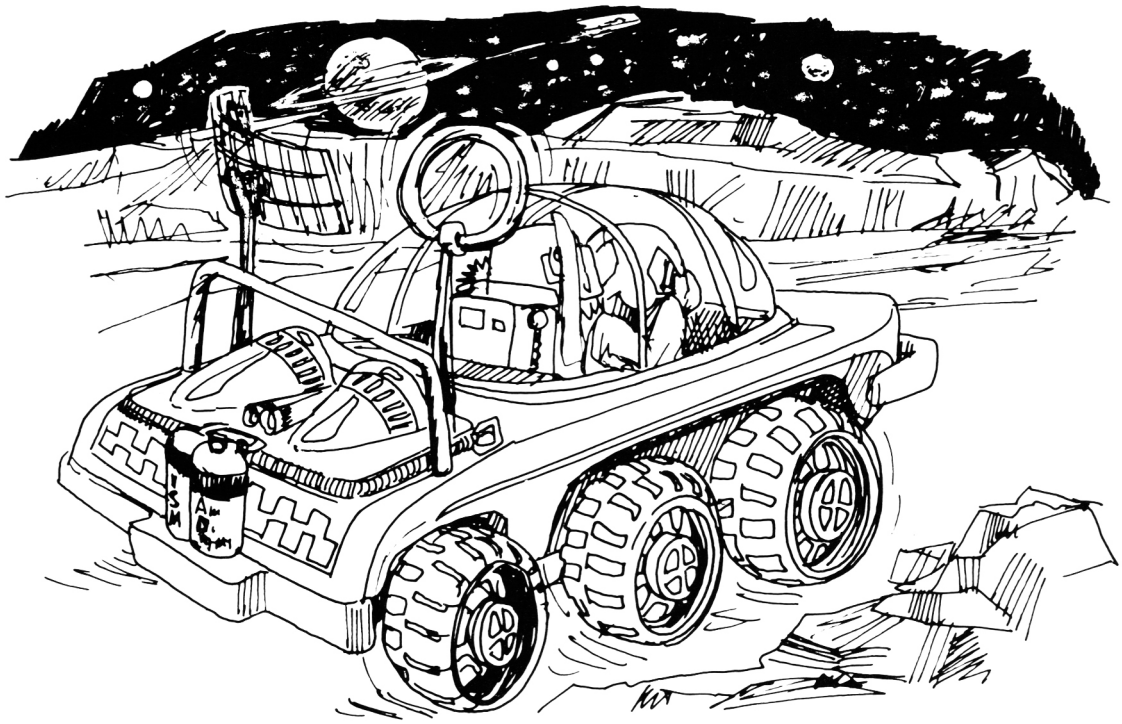
1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed

You are going to

Use the problem-solving process.

Space vehicle

Your development team must prepare a report and build a model of a mobile space vehicle. It should be capable of avoiding obstacles in its path.



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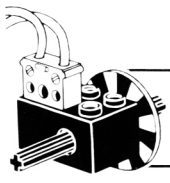


a i s e c t

Assignment: 9e

Designing a programmed system

A9e

You will need

1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed

You are going to

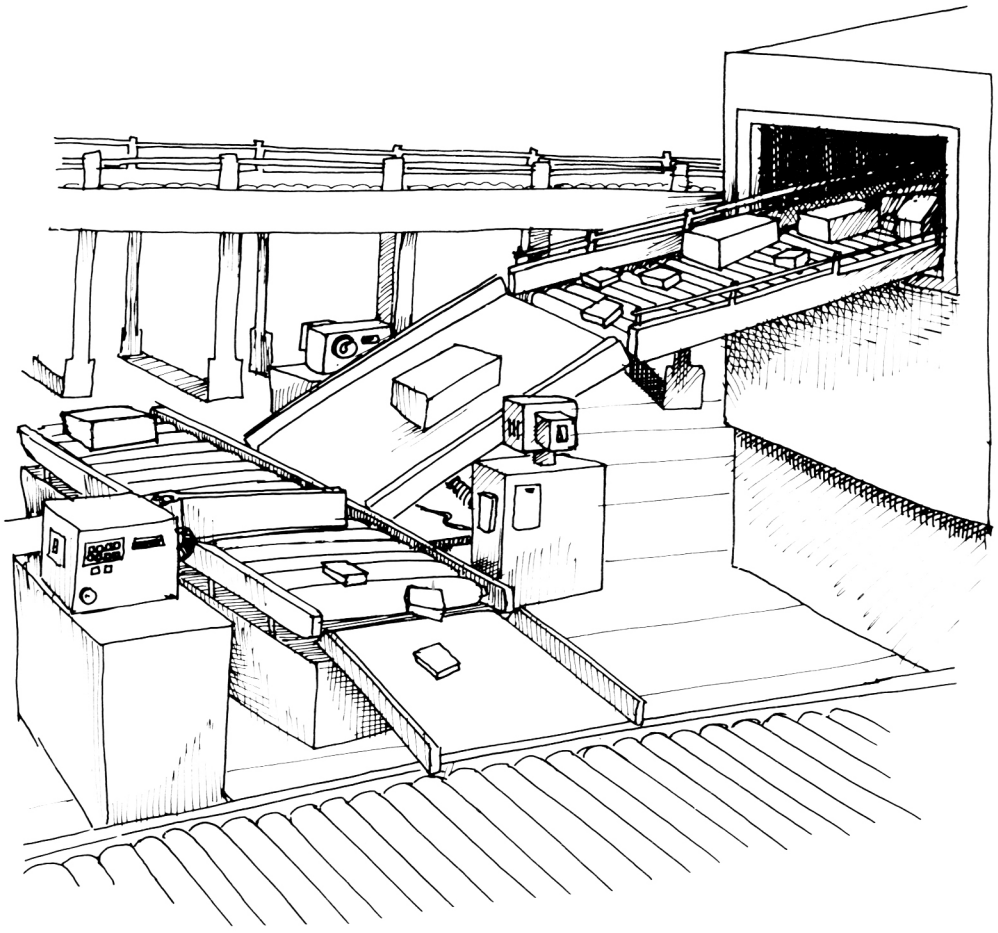
Use the problem-solving process.

Conveyor system

A manufacturer wishes to install a computerised conveyor system in the factory.

The system must be capable of sorting out large boxes on the conveyor from smaller ones.

Your team should build a model of the most appropriate solution, and submit a report on your work to the management.



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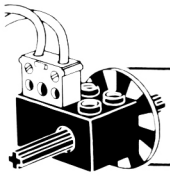


Assignment: 9f

Designing a programmed system

A9f

You will need

1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed

You are going to

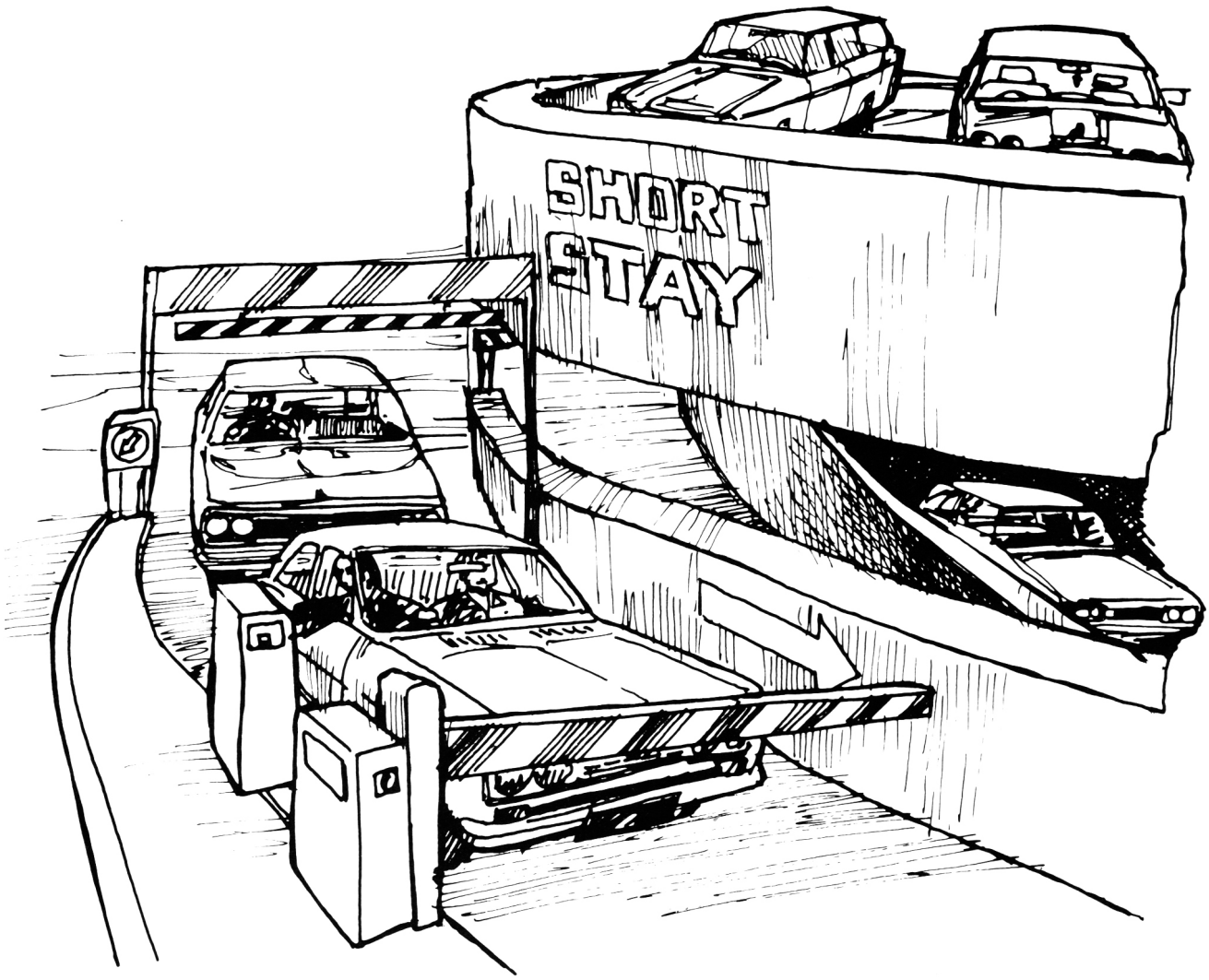
Use the problem-solving process.

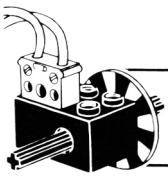
Car Park Barrier

Design an automatic barrier for a multistorey car park.

Care must be taken to ensure that the system your team suggests is efficient and safe.

A model and a report are required.





a i s e c t

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Assignment: 9g

Designing a programmed system

A9g

You will need

1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed

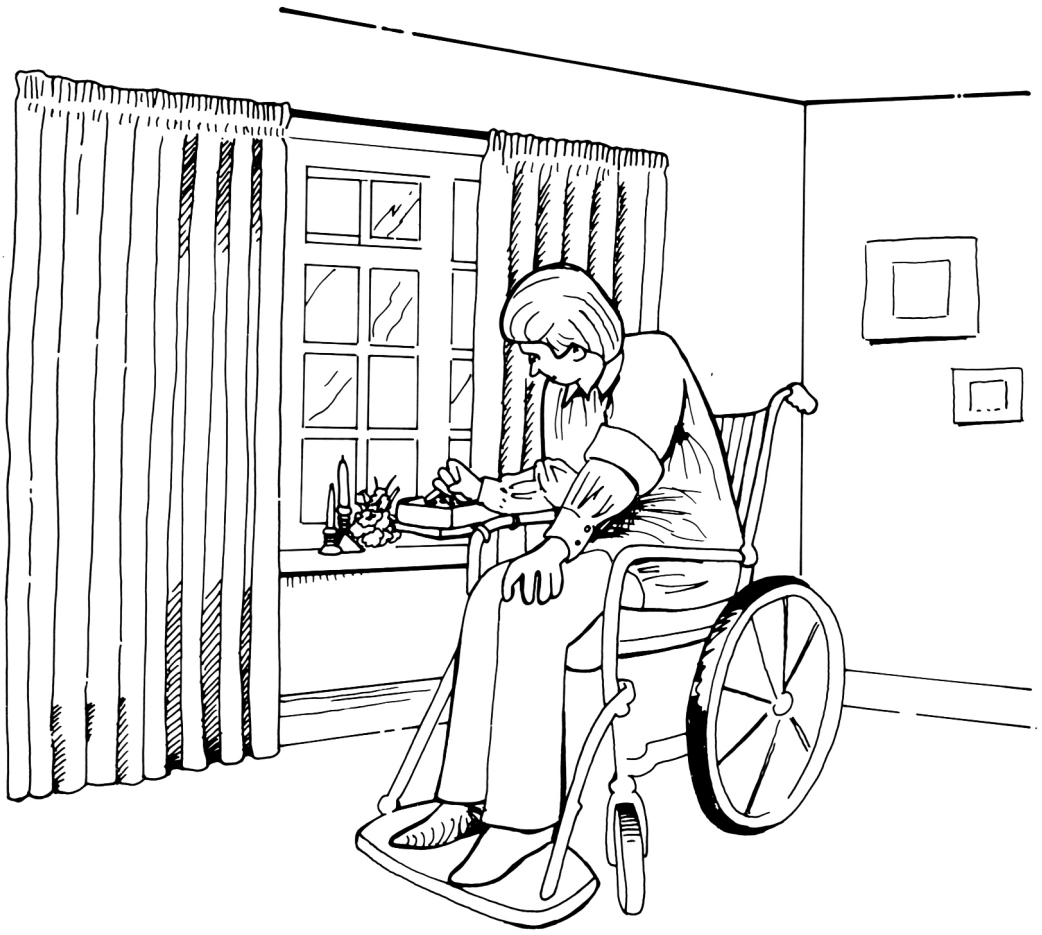
You are going to

Use the problem-solving process.

Automatic Curtains

Your team has been commissioned to design a set of curtains which open and close automatically. These would be particularly useful to elderly or disabled people.

Prepare a report of your work and a model of your solution.



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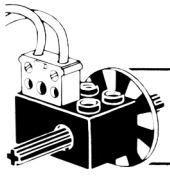


a i s e c t

Assignment: 9h

Designing a programmed system

A9h

You will need

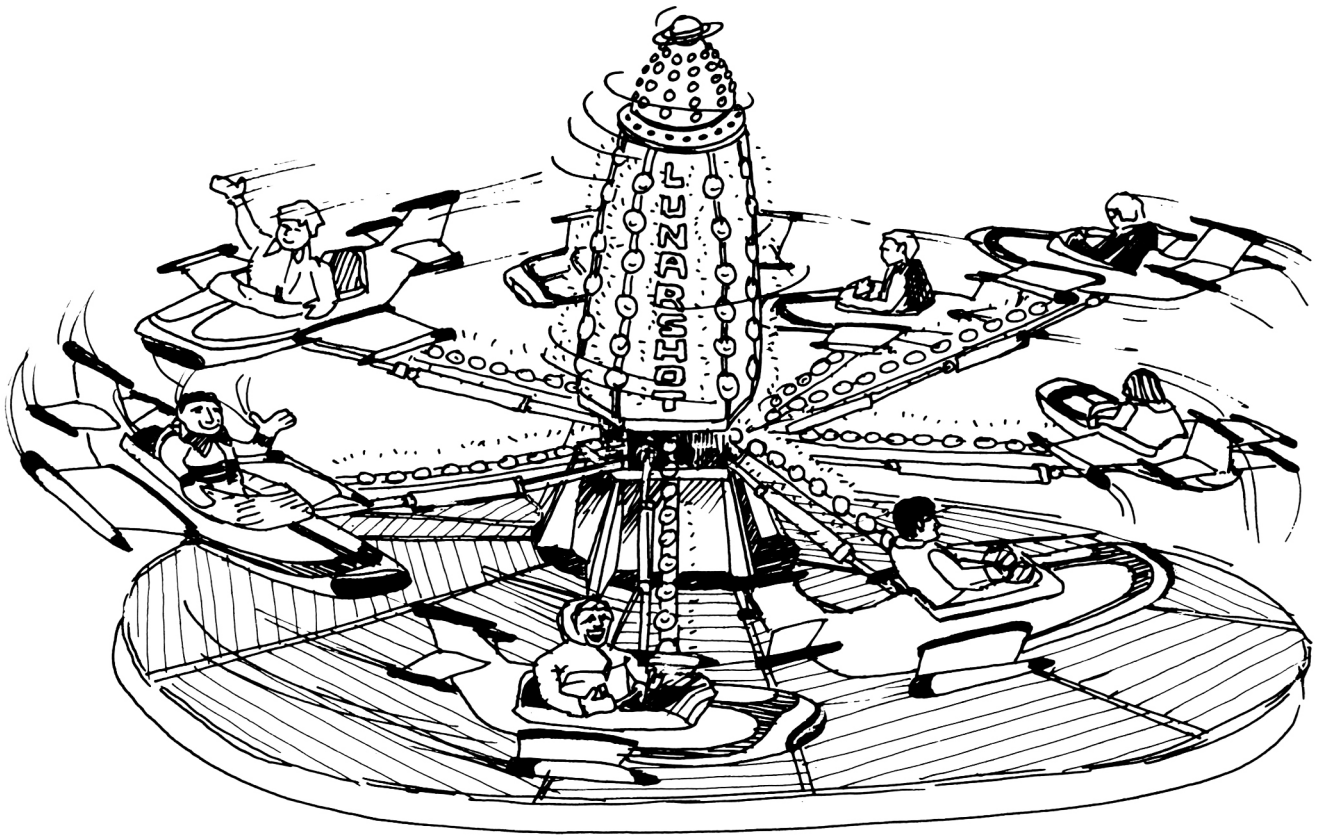
1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed

You are going to

Use the problem-solving process.

Roundabout

A leisure park wishes to install an automatically controlled roundabout. They have commissioned your team to produce a working model and a report of your design.



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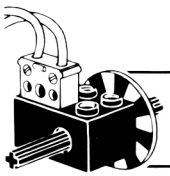


a i s e c t

Assignment: 9i

Designing a programmed system

A9i

You will need

1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed
Plasticine block

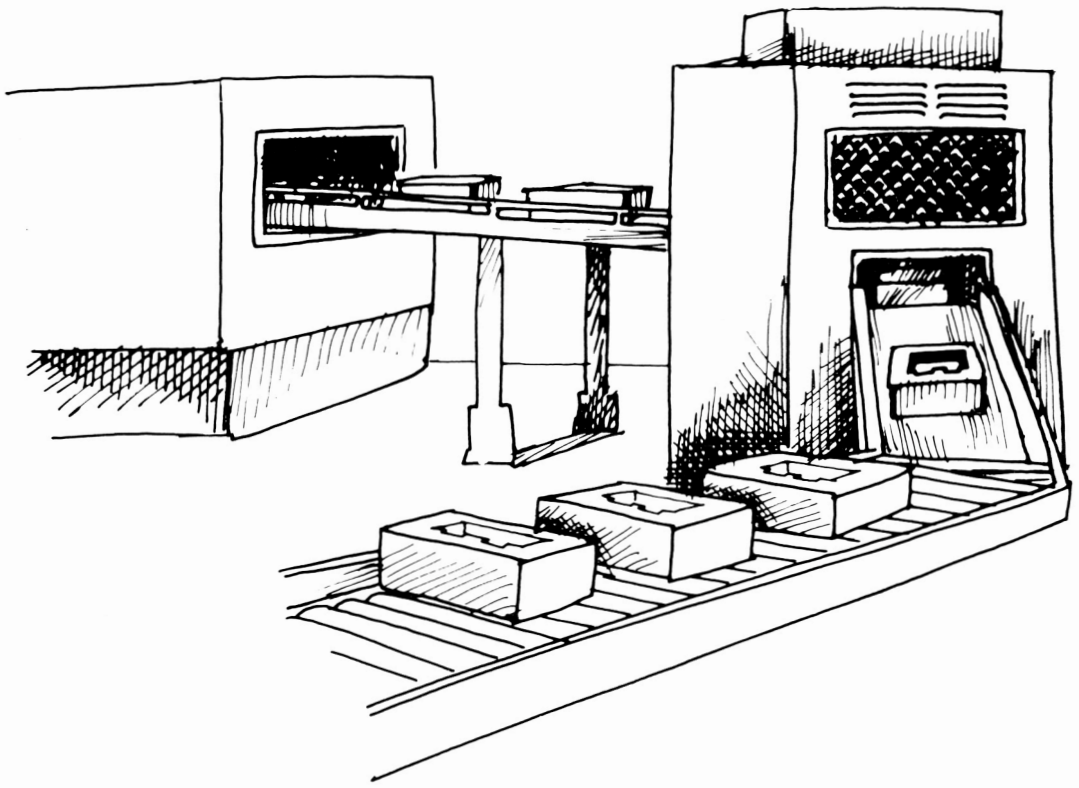
You are going to

Use the problem-solving process.

Pressing machine

Your team should design a device which will automatically stamp the pattern of a LEGO brick onto a block of plasticine when it is placed onto a platform.

A report and a working model are required.



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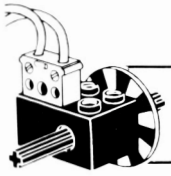


a i s e c t

Assignment: 9j

Designing a programmed system

A9j

You will need

1090 LEGO Set
Computer system and LEGO *Lines* disk
Resources booklet
Assignments you have completed

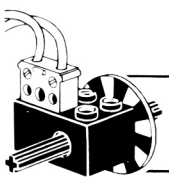
You are going to

Use the problem-solving process.

Stage Effect

Your team has been commissioned to design a head to be mounted on a wall as part of a fantasy play. The head is required to 'come alive' each time one of the cast passes a certain spot.

Prepare a report of your ideas and a working model.



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