```
90 POKEDATREG=1:REM TURN ON
100 FORI=1TOSPEED:NEXT:REM DELAY2
110 IFA$="D"THENSPEED=SPEED-5
120 IFA$="Z"THENSPEED=SPEED+5
130 IFA$<>"X"THEN60
140 POKEDATREG,0:REM TURN OFF
```

In this program the variable SPEED is used to determine the length of each delay loop. The loop code is such that as one delay increases, the other decreases and vice-versa. DELAY 1 determines the period when the motor is off and DELAY 2 the period when the motor is on. For large values of SPEED, the first delay is short and the second is long, making the motor turn more quickly. Smaller values of SPEED will produce longer periods when the motor is off during each cycle, making the motor appear to turn more slowly. The pulsing effect that the program has can be observed in the flicker of line 1's LED.

So Far, So Good

Driving wire guided toy cars around on the floor may not seem an enormous return on the effort and capital invested, but building and programming even these simple artefacts has introduced us to the reality of electronic and electromechanical construction, and demonstrated some of the problems and opportunities involved in making software interact with the real world

LEGO CONSTRUCTION BY DAVE WHELAN

IAN McKINNELL

Exercise Answers

1) Assuming that the sensors are connected to lines 6 and 7, and the motor is connected between the positive terminals of lines 0 and 1:

```
10 REM BBC VERSION 3.1
20 DDR=&FE62:DATREG=&FE60
30 ?DDR=63:REM LINES 6&7 INPUT
40 forward=1:reverse=2
50 ?DATREG=forward
60 FORI=1TO2000:NEXT:REM DELAY
70 REPEAT UNTIL(?DATREG AND192)<>192
80 ?DATREG=reverse
90 FORI=1TO2000:NEXT REM DELAY
100 IF(?DATREG AND192)<>192 THEN50
    ELSE GOTO100
```

```
10 REM CBM 64 VERSION 3.1
20 DDR=56579:DATREG=56577
30 POKEDDR,63:REM LINES 6&7 INPUT
40 FW=1:RV=2
50 POKE DATREG,FW
60 FORI=1TO1000:NEXT:REM DELAY
70 IF(PEEK(DATREG)AND192)=192THEN70
80 POKE DATREG,RV
90 FORI=1TO1000:NEXT:REM DELAY
100 IF(PEEK(DATREG)AND192)<>192THEN50
110 GOTO100
```

2) Assuming that the sensor connects to line 7 and the motor connects between lines 0 and 1:

```
10 REM BBC VERSION 3.2
20 DDR=&FE62:DATREG=&FE60
30 ?DDR=127:REM LINE 7 INPUT
40 speed=30:forward=1:reverse=2
50 direction=forward
60 REPEAT
70 ?DATREG=0:REM OFF
80 FORI=1TO(100-speed):NEXT
90 ?DATREG=direction
100 FORI=1TOspeed:NEXT
110 UNTIL(?DATREG AND128)=0:REM SWITCH
120 FORI=1TO1000:NEXT:REM DELAY
130 REM TEST FOR OVER PAD
140 IF(?DATREG AND128)=0THEN?DATREG=0:
    END
150 REM REVERSE SLOWLY
160 speed=2:direction=reverse:GOTO60
```

```
10 REM CBM 64 VERSION 3.2
20 DDR=56579:DATREG=56577
30 POKE DDR,127:REM LINE 7 INPUT
40 SP=30:FW=1:RV=2
50 DR=FW
60 POKE DATREG,0: REM OFF
70 FORI=1TO(100-SP):NEXT
80 POKE DATREG,DR
90 FORI=1TOSP:NEXT
100 IF(PEEK(DATREG)AND128)<>0THEN60
110 FORI=1TO1000:NEXT:REM DELAY
120 IF(PEEK(DATREG)AND128)=0THENPOKE
    DATREG,0:END
130 REM REVERSE BACK SLOWLY
140 SP=2:DR=RV:GOTO60
```

3) Assuming that the 40 and 70 degree sensors are connected to lines 6 and 7 respectively, and the heater is attached to line 0:

```
10 REM BBC VERSION 3.3
20 DDR=&FE62:DATREG=&FE60
30 ?DDR=63:REM LINES 6&7 INPUT
40 REPEAT
50 A$=INKEY$(1)
60 ?DATREG=1:REM TURN ON HEATER
70 REPEAT
80 UNTIL(?DATREG AND192)=0:REM 70 DEG
90 ?DATREG=0:REM HEATER OFF
100 REPEAT UNTIL(?DATREG AND192)=192
110 UNTIL A$<>"":REM KEYPRESS
```

```
10 REM CBM 64 VERSION 3.3
20 DDR=56579:DATREG=56577
30 POKE DRR,63:REM LINES 6&7 INPUT
40 GET A$
50 ?DATREG=1:REM TURN HEATER ON
60 IF(PEEK(DATREG)AND192)<>0THEN60
70 POKE DATREG,0:REM HEATER OFF
80 IF(PEEK(DATREG)AND192)<>192THEN80
90 IF A$=""THEN40
```

4) Assuming that the first switch is on line 6 and the second is on line 7:

```
10 REM BBC VERSION 3.4
20 DDR=&FE62:DATREG=&FE60:DISTANCE=1
30 ?DDR=63
40 REPEAT UNTIL(?DATREG ANDG4)=0
50 ?DATREG=1
60 TIME=0:REM START TIMER
70 REPEAT UNTIL(?DATREG AND128)=0
80 PRINT"SPEED="DISTANCE/(TIME/100)
90 ?DATREG=0
```

```
10 REM CBM 64 VERSION 3.4
20 DDR=56578:DATREG=56577:DS=1
30 POKE DDR,63
40 IF(PEEK(DATREG)AND64)<>0THEN40
50 POKE DATREG,1
60 T=TI:REM START TIMER
70 IF(PEEK(DATREG)AND128)<>0THEN60
80 PRINT"SPEED="DS/((TI-T)/60)
90 POKE DATREG,0
```