



FOR OFFICIAL USE

--	--	--	--	--	--

National
Qualifications
2026

Mark

--

X860/75/02**Practical Electronics**

THURSDAY, 7 MAY

1:30 PM – 2:30 PM



* X 8 6 0 7 5 0 2 *

Fill in these boxes and read what is printed below.

Full name of centre

--

Town

--

Forename(s)

--

Surname

--

Number of seat

--

Date of birth

Day

--	--

Month

--	--

Year

--	--

Scottish candidate number

--	--	--	--	--	--	--	--	--

Total marks — 60

Attempt ALL questions.

You may use a calculator.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting.

Use **blue** or **black** ink.

Do not remove any exam materials. You must leave this booklet on your desk; if you do not, you could lose all the marks for this paper.



* X 8 6 0 7 5 0 2 0 1 *

Total marks — 60
Attempt ALL questions

1. The table below gives information about some circuit components.
Some of the boxes have been left blank.

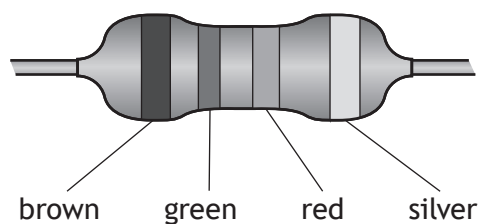
(a) Complete the table for the missing entries.

3

Component name	Symbol	Function
Bipolar transistor		electronic switch
		controls the current in a circuit
Ammeter		measures current in a circuit
Light dependent resistor (LDR)		

1. (continued)

(b) The diagram below shows the colour coding for a resistor.



Using information from the data sheet, answer the questions below.

- (i) Determine the resistance of the resistor. 1
- (ii) State the percentage tolerance of this resistor. 1
- (iii) Determine the maximum and minimum resistance of this resistor in ohms. 2

[Turn over



1. (continued)

- (c) The table below shows possible values for the resistance of a resistor in different notations.

220 R	22
2.2 mΩ	2M2

Identify which of the values shown is the **largest** value of resistance.

1



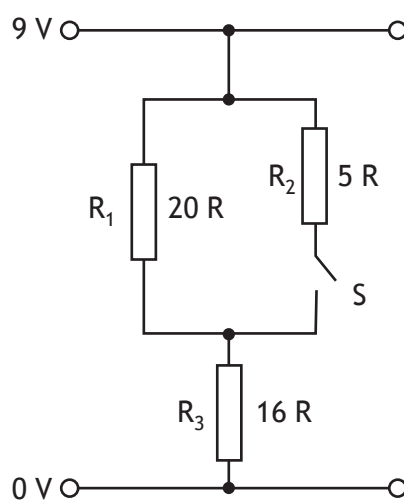
2. State two safety precautions that must be taken when using a soldering iron.

2

[Turn over



3. A circuit diagram is shown below.



(a) Switch S is open.

(i) Calculate the total resistance of this circuit.

Space for working and answer

1

(ii) Calculate the current in this circuit.

Space for working and answer

3



3. (a) (continued)

(iii) Calculate the power dissipated in resistor R_3 .

Space for working and answer

3

(b) Switch S is now **closed**.

(i) Calculate the effective resistance of the two resistors in parallel.

Space for working and answer

3

(ii) Calculate the overall circuit resistance.

Space for working and answer

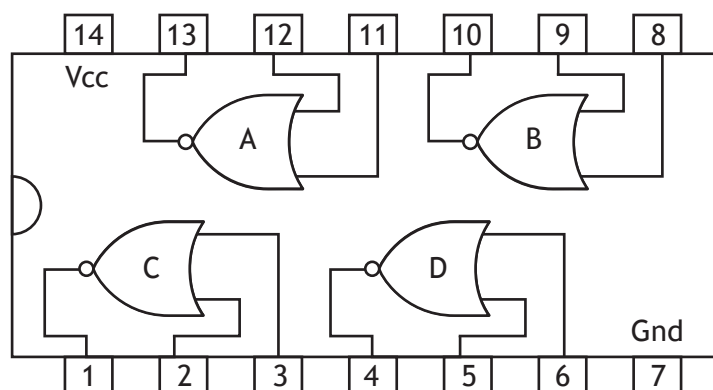
1

[Turn over



4. Logic gates are widely used in electronic circuits.

(a) A pinout for a 74 series logic chip is shown below.



(i) Using information from the data sheet, identify the **integrated circuit (IC)** shown.

1

(ii) Identify an **output** pin on the integrated layout diagram above.

1

(iii) With reference to logic gate **A**, on the above pinout diagram, pins 12 and 13 have a logic state of 0.

State the logic state at pin 11.

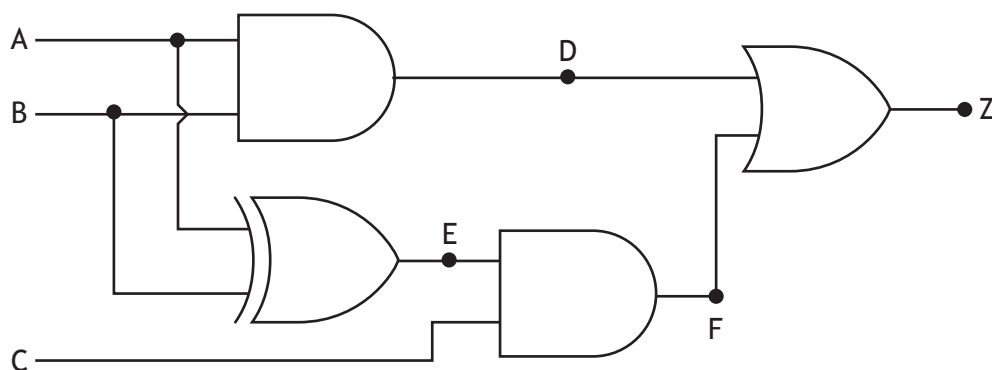
1



4. (continued)

(b) Complete the truth table for the logic circuit shown below.

4



A	B	C	D	E	F	Z
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				

(An additional truth table, if required, can be found on *page 20*.)

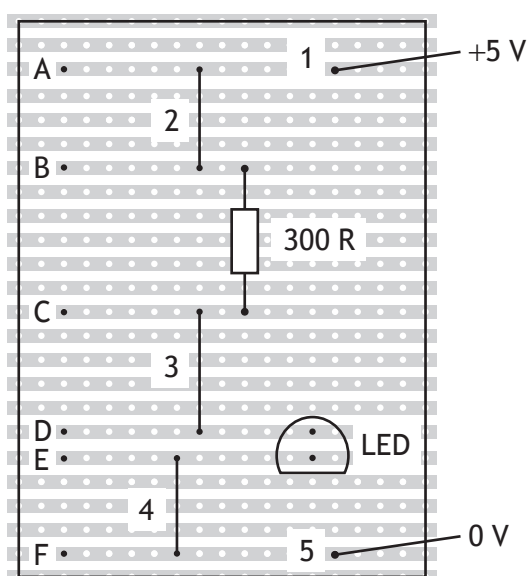
[Turn over

5. (a) State an advantage of colour coding wires.

1

(b) A student plans a stripboard layout of an LED in series with a resistor.

The layout, shown below, includes wires and test points. The wires are labelled one to five. The test points are marked A to F.



(i) The layout includes wires of different insulation colours: red, blue and black.

Identify the wire number that should have blue insulation.

1

5. (b) (continued)

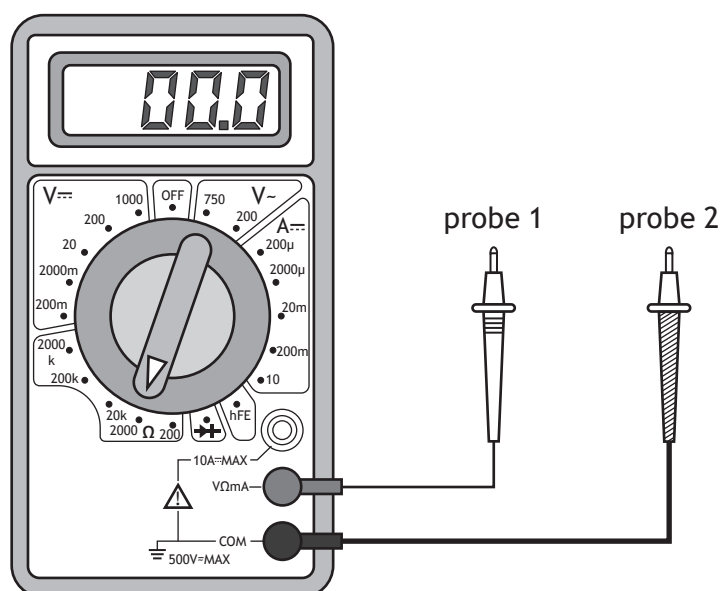
(ii) Explain the purpose of the resistor in the circuit.

1

(iii) The student now constructs the circuit from part (b).

Before connecting the stripboard to the supply, the student tests for continuity using a multimeter.

The multimeter used is shown below and will sound a 'beep' to indicate continuity.



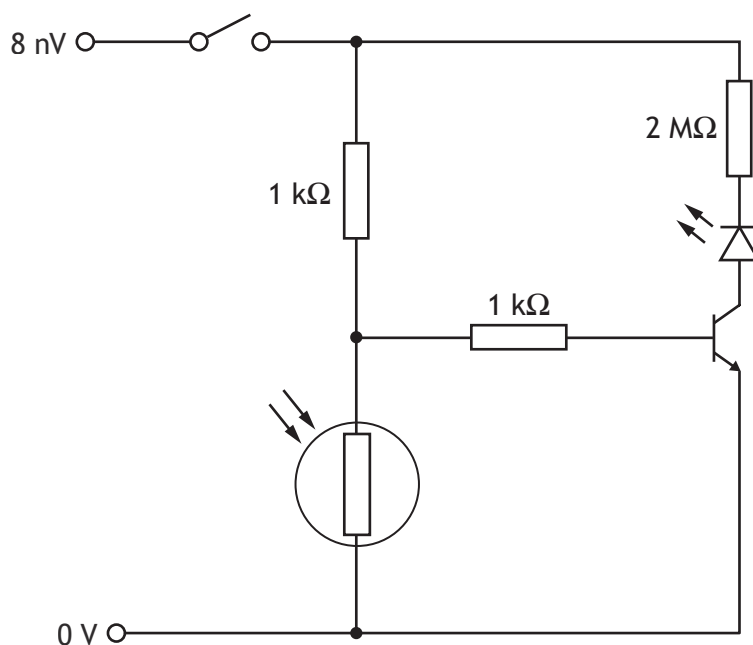
Describe how the above multimeter can be used to test for continuity between the LED and 0 V rail line on the student's stripboard.

3

[Turn over



6. A student simulated the circuit shown.



Identify three errors in this simulation.

3

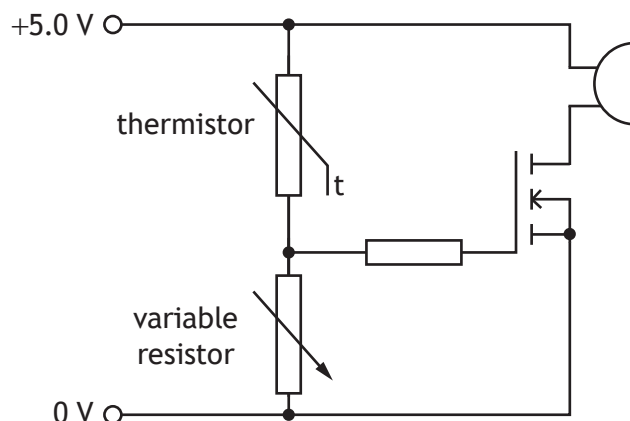
Error 1:

Error 2:

Error 3:



7. An alarm circuit has a buzzer that sounds when the temperature is too high. The circuit diagram for the buzzer system is shown below.



- (a) At a certain temperature, the thermistor has a resistance of $1000\ \Omega$.
The variable resistor is set at a resistance of $1500\ \Omega$.
Calculate the voltage across the variable resistor.
Space for working and answer

3

- (b) Explain how the circuit operates to sound the buzzer.

3

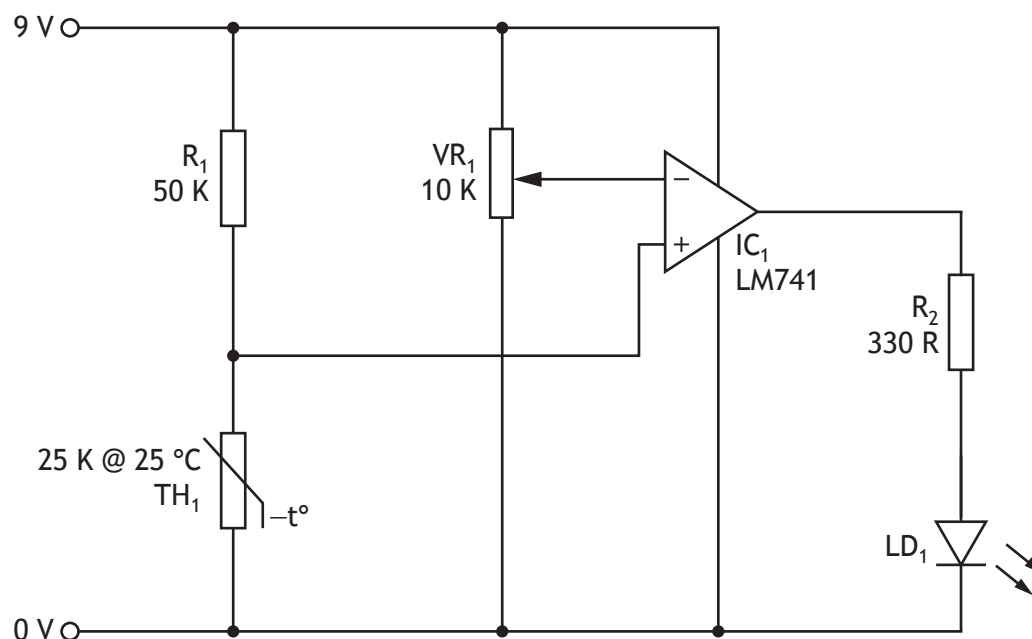
- (c) State the purpose of the variable resistor in this circuit.

1

[Turn over



8. A student builds the circuit shown.



Using the information from the two suppliers' catalogues shown on the opposite page, complete the costings sheet below to produce the **lowest** cost for the circuit.

5

Supplier	Component	Product code	Cost (p)
JIMSON	LM741CN	TC 133	56
SWIFT	8 way DIL	SK-0080	10
	LED 5 mm std		
	330 R		
	50 K		
	10 K potentiometer		
	thermistor		

(An additional costings sheet, if required, can be found on page 20.)

8. (continued)

DO NOT
WRITE IN
THIS
MARGIN

Supplier — SWIFT				
	Component	Description	Product code	Cost
Integrated circuits	LM741CN	op-amp	IC-0258	75 p
	UA741CP	op-amp	IC-0267	41 p
	OP070CP	op-amp	IC-0234	110 p
	8 way DIL	IC socket	SK-0080	10 p
Semi-conductors	LED	5 mm std red	SC-0155	4 p
	LED	10 mm std red	SC-0177	10 p
Thermistor	thermistor	5 K @ 25 °C	BB-0545	65 p
	thermistor	10 K @ 25 °C	BB-0556	50 p
	thermistor	25 K @ 25 °C	BB-0568	28 p
Resistors	50 K	0.25 W carbon film 5%	FR-0855	2.8 p
	4K7	0.25 W carbon film 5%	FR-0856	2 p
	330 R	0.25 W carbon film 5%	FR-0857	1.5 p
Potentiometer	25 K	0.5 W trimmer	PT-0765	95 p
	10 K	0.5 W trimmer	PT-0744	55 p
	1 M	0.5 W trimmer	PT-0732	35 p
Supplier — JIMSON				
	Component	Description	Product code	Cost
Integrated circuits	LM741CN	op-amp	TC 133	56 p
	UA741CP	op-amp	TC 134	36 p
	OP070CP	op-amp	TC 135	105 p
	8 way DIL	IC socket	SK 090	30 p
Semi-conductors	LED	5 mm std red	LD 345	12 p
	LED	10 mm std red	LD 346	25 p
Thermistor	thermistor	5 K @ 25 °C	TH 114	32 p
	thermistor	10 K @ 25 °C	TH 115	45 p
	thermistor	25 K @ 25 °C	TH 116	22 p
Resistors	50 K	0.25 W carbon film 5%	CR 654	2.5 p
	4K7	0.25 W carbon film 5%	CR 655	1.7 p
	330 R	0.25 W carbon film 5%	CR 656	1.2 p
Potentiometer	25 K	0.5 W trimmer	VT 250	92 p
	10 K	0.5 W trimmer	VT 251	65 p
	1 M	0.5 W trimmer	VT 252	40 p



9. An engineer designs a system to control the temperature of the water in a tropical fish tank.

The system requires an electric heater to turn on when the temperature of the water becomes too cold.

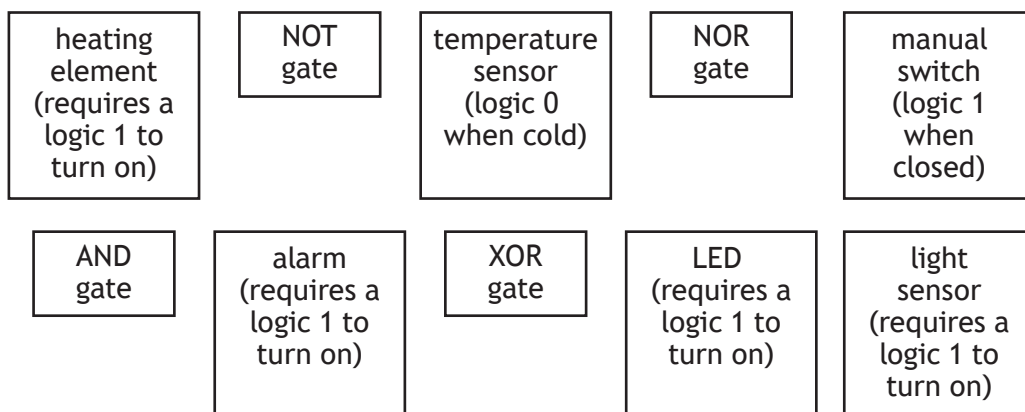
An LED should switch on when the heater is on.

There is also a manual switch to turn the whole system on and off.

Selecting from the elements given, draw a block diagram of an electronic solution for this system.

On your diagram, clearly indicate the input, process and output sections of your solution.

6

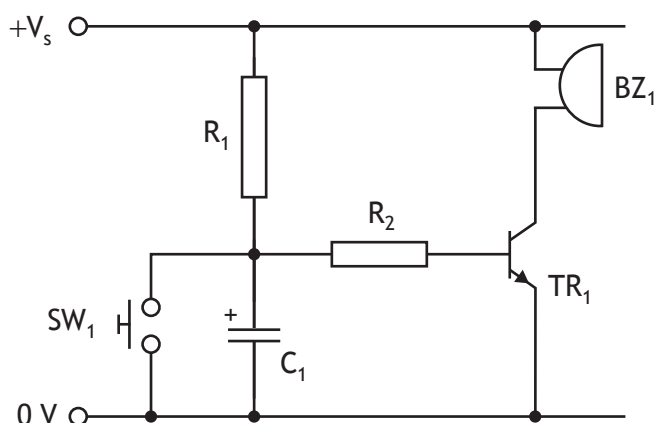


[Turn over for next question

DO NOT WRITE ON THIS PAGE



10. A time delay circuit is shown below.



Component data

R_1 — carbon film 10 k Ω 0.25 W

R_2 — carbon film 1 k Ω 0.25 W

C_1 — 2200 mF **electrolytic** capacitor

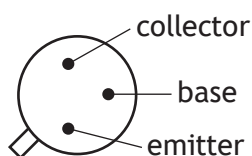
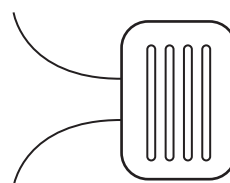
SW_1 — push-to-make switch

TR_1 — BC108 npn bipolar

BZ_1 — buzzer 6 V dc

TR_1 pin connections

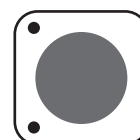
buzzer with connecting wires



electrolytic capacitor



push-to-make switch



On the opposite page, a layout diagram includes the power rails and components TR_1 and R_2 .

Complete the layout diagram with the remaining components.

Each component must be identified by a label.

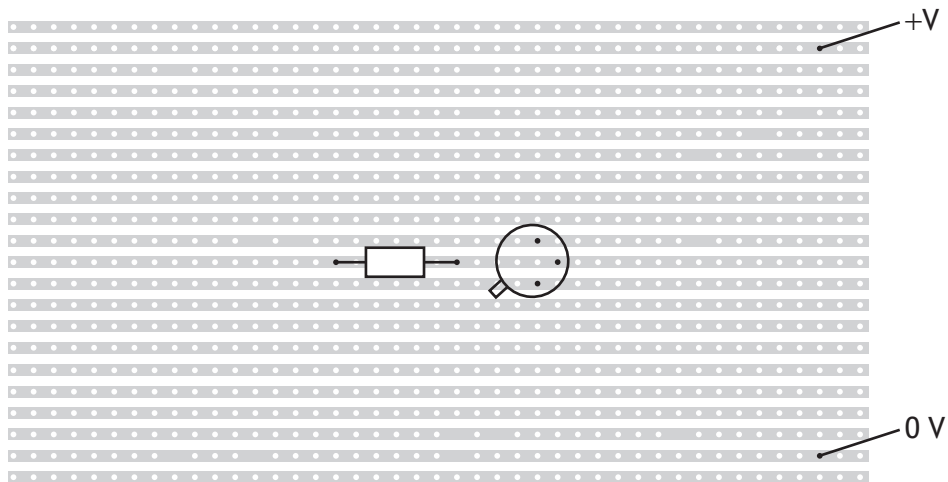
Mark on the layout diagram, with an X, where a track has been cut.

5



10. (continued)

layout diagram



(An additional layout diagram, if required, can be found on *page 21*.)

[END OF QUESTION PAPER]



ADDITIONAL SPACE FOR ANSWERS

Additional truth table for question 4 (b)

A	B	C	D	E	F	Z
0	0	0				
0	0	1				
0	1	0				
0	1	1				
1	0	0				
1	0	1				
1	1	0				
1	1	1				

Additional costings sheet for question 8

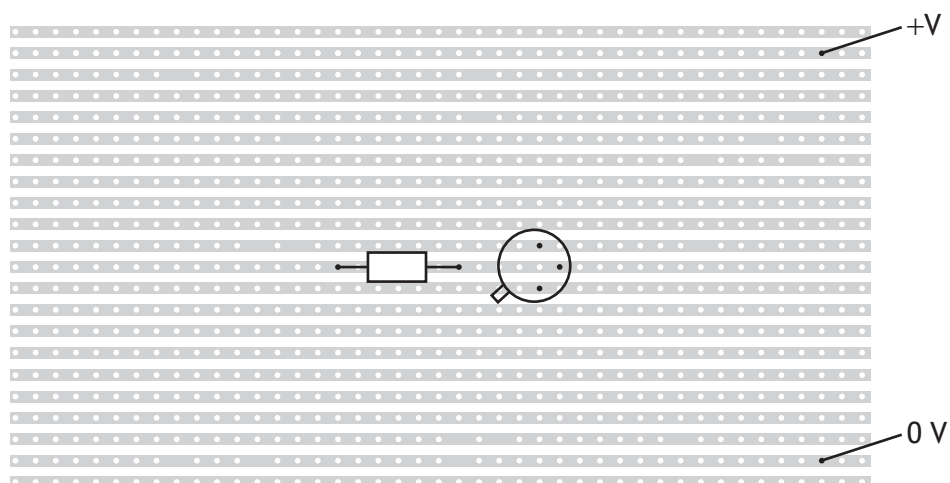
Supplier	Component	Product code	Cost (p)
JIMSON	LM741CN	TC 133	56
SWIFT	8 way DIL	SK-0080	10
	LED 5 mm std		
	330 R		
	50 K		
	10 K potentiometer		
	thermistor		



ADDITIONAL SPACE FOR ANSWERS

Additional diagram for question 10

layout diagram



ADDITIONAL SPACE FOR ANSWERS

DO NOT
WRITE IN
THIS
MARGIN



* X 8 6 0 7 5 0 2 2 2 *

ADDITIONAL SPACE FOR ANSWERS

DO NOT
WRITE IN
THIS
MARGIN



* X 8 6 0 7 5 0 2 2 3 *

[BLANK PAGE]

DO NOT WRITE ON THIS PAGE

