

Question paper



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Examination
Electronics Servicing — Part III

Friday
9 December 1988

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Paper
Microprocessor computer systems

14 00 – 17 00
3 hours

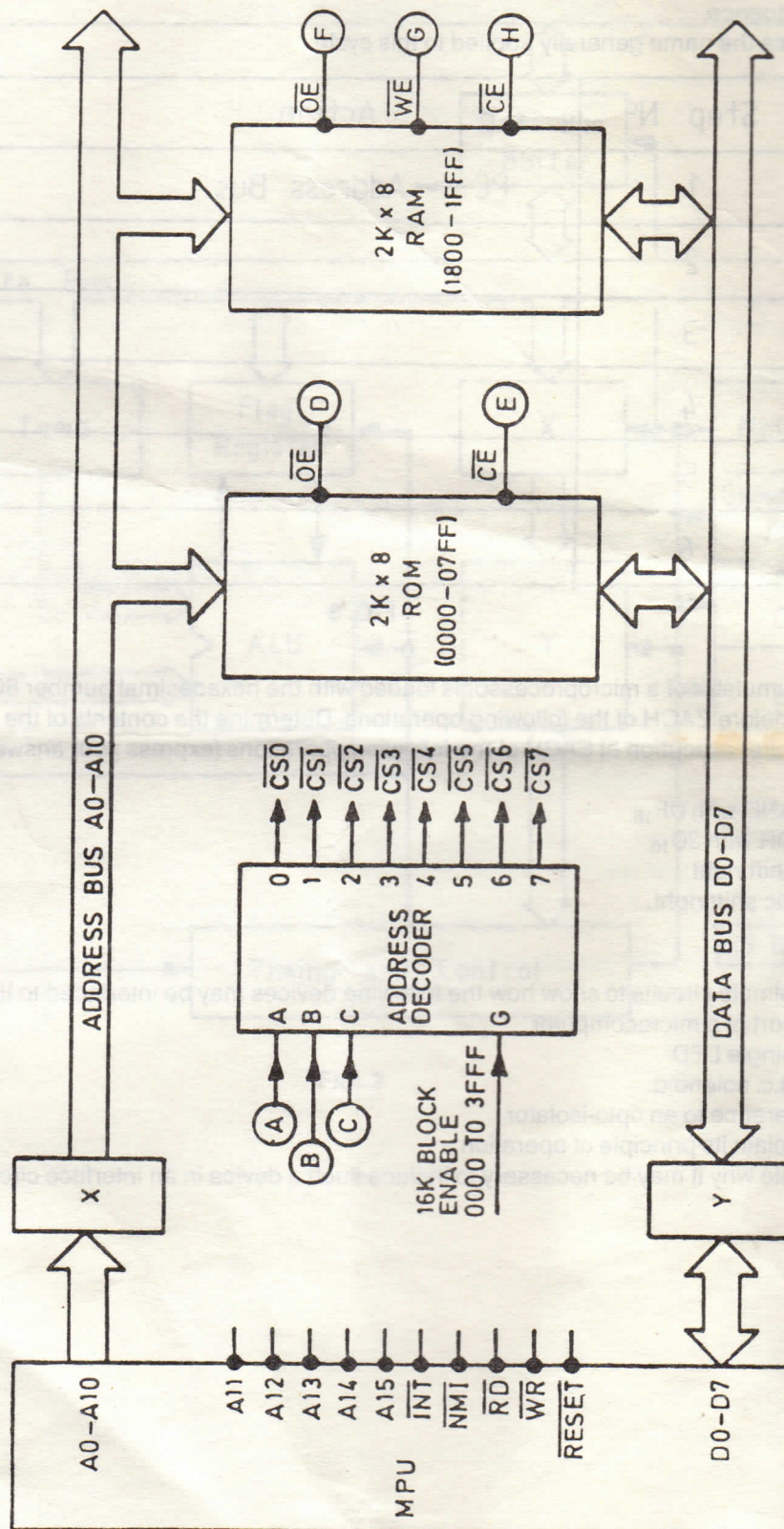
You should have the following for this examination
one answer book

All questions carry equal marks. The marks for each part of a question are shown in brackets.

Answer ALL FIFTEEN questions.

- ① Showing all working in EACH part of this question
- a) convert the decimal number 62 into hexadecimal (2 marks)
 - b) convert the hexadecimal number $C4_{16}$ into its signed decimal equivalent (4 marks)
 - c) use complementation to perform the following calculation, (4 marks)
 $38_{16} - 1E_{16}$
- ② Refer to Fig. 1 (a) (attached) which shows the flowchart for a 4-bit binary division using the register arrangement shown in Fig. 1 (b).
- a) State the operation which must be performed in (4 marks)
 - i) box A
 - ii) box C.
 - b) State the test which must be performed in (4 marks)
 - i) box B
 - ii) box D. (2 marks)
 - c) State the name of the contents of register Z at the end of the division process.

- 7 Refer to Fig. 4 below which shows the incomplete diagram of a microcomputer.
- a) Name EACH of the points on the diagram to which (A), (B), (C), (D), (E), (F), (G) and (H) are normally connected. (8 marks)
- b) Name blocks X and Y on the diagram, and briefly state their function. (2 marks)



Microcomputer Circuit

FIG. 4

- 8) Refer to Fig. 5 (a) and 5 (b). A microcomputer has an I/O port which is memory mapped at address 3000_{16} . A digital to analogue (D/A) converter is connected to this port. A program is required to generate a ramp (saw tooth) waveform at the output of the D/A converter. Port configuration and output frequency need not be considered.
- a) Construct a flowchart for this program. (5 marks)
- b) Using codes selected from Fig. 5 a), write a program starting at address 0100_{16} . Write your program in the form shown in Fig. 5 b). (5 marks)

INSTRUCTION	MNEMONIC	ADDRESSING MODE			
		IMP	REL	IMM	EXT
ADD WITH CARRY	ADC	-	-	69	6D
BRANCH IF CARRY CLEAR	BCC	-	90	-	-
BRANCH IF CARRY SET	BCS	-	80	-	-
BRANCH IF MINUS	BMI	-	30	-	-
BRANCH IF PLUS	BPL	-	10	-	-
CLEAR CARRY FLAG	CLC	18	-	-	-
HALT	HLT	00	-	-	-
INCREMENT	INC	-	-	-	EE
LOAD ACCUMULATOR	LDA	-	-	A9	AD
STORE ACCUMULATOR	STA	-	-	-	8D

IMP = IMPLIED OR INHERENT
REL = RELATIVE
IMM = IMMEDIATE
EXT = EXTENDED OR ABSOLUTE

FIG. 5 (a)

ADDRESS	MACHINE CODE	MNEMONIC

FIG. 5 (b)

- 9) Refer to Fig. 6 which shows a memory device.
- a) State, with a reason, the type of memory device shown in Fig. 6. (2 marks)
- b) State, with TWO reasons, the storage capacity of the chip. (3 marks)
- c) Explain the purpose of the pin marked V_{pp}. (2 marks)
- d) Explain the purpose of the pin marked PD/PGM. (3 marks)

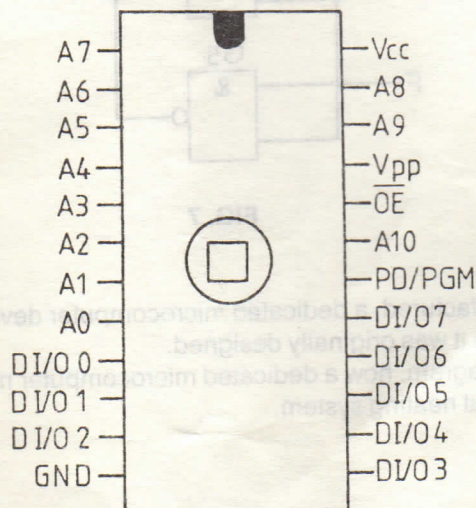


FIG. 6

- ③ Refer to Fig. 2.
- Name Blocks X and Y. (2 marks)
 - State the function of TWO flags in the Flag Register. (2 marks)
 - Describe the function of the Program Counter. (3 marks)
 - Describe the function of the Stack Pointer. (3 marks)

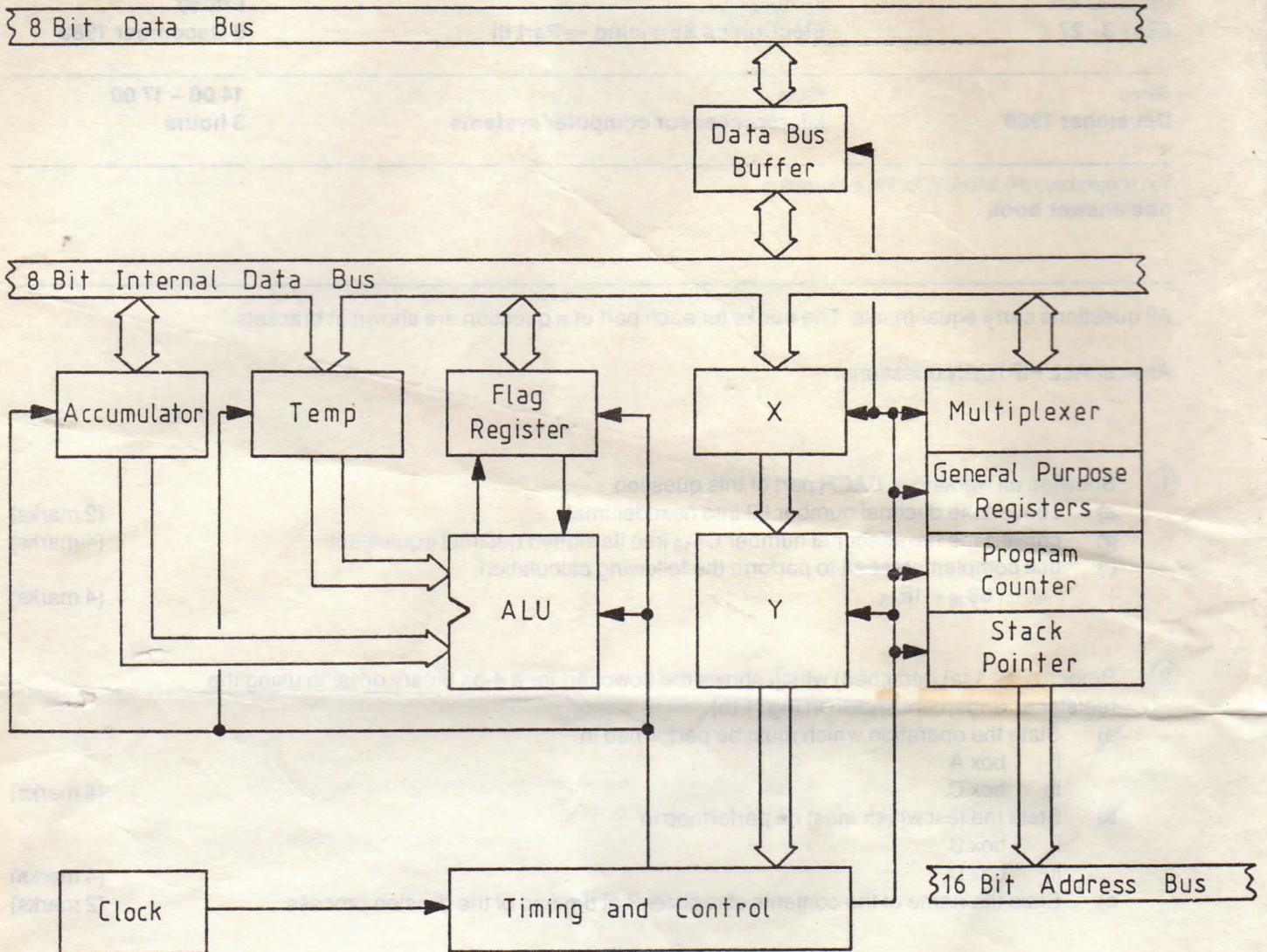


FIG. 2

- 4 a) Name the TWO parts of a microprocessor instruction using a 'Load Accumulator' instruction as an example. (4 marks)
- b) Refer to Fig. 3.
- i) List the SIX steps of the cycle, in correct sequence, which occurs when a 'Load Accumulator Immediate' instruction is carried out. Tabulate your answer in the answer book in the form shown in Fig. 3 which shows the first step of the sequence.
- ii) State the name generally applied to this cycle. (6 marks)

Step N°	Action
1	PC → Address Bus
2	
3	
4	
5	
6	

FIG. 3

- 5 The 8-bit accumulator of a microprocessor is loaded with the hexadecimal number $8C_{16}$ (10001100_2) before EACH of the following operations. Determine the contents of the accumulator after execution of EACH of the following operations (express your answers in hexadecimal)
- a) logical AND with $0F_{16}$ (2 marks)
- b) logical OR with 30_{16} (2 marks)
- c) logical shift right (3 marks)
- d) arithmetic shift right. (3 marks)
- 6 a) Sketch simple circuits to show how the following devices may be interfaced to the output port of a microcomputer
- i) a single LED
- ii) a d.c. solenoid. (4 marks)
- b) With reference to an opto-isolator
- i) explain its principle of operation
- ii) state why it may be necessary to include such a device in an interface circuit. (6 marks)

- 10 a) State TWO advantages of using a floppy disk rather than cassette tape for the bulk storage of programs and data. (2 marks)
- b) State TWO reasons why all of the storage capacity of a floppy disk is not available for the storage of user programs. (2 marks)
- c) Explain briefly why a new disk must be 'formatted' before it can be used to store programs. (4 marks)
- d) State TWO precautions which should be adopted when handling floppy disks. (2 marks)
- 11 a) State the difference between the printing mechanism of impact and non-impact types of printer. (2 marks)
- b) Describe, with the aid of sketches, TWO methods of printing used in non-impact types of printer. (6 marks)
- c) Name TWO types of interface that are commonly used to connect a printer to a microcomputer. (2 marks)
- 12 a) Describe the principle of operation of a current tracer. (4 marks)
- b) Refer to Fig. 7. The output of one of the NAND gates is stuck permanently at 0V. List the steps which should be taken in order to locate the faulty gate, using a logic pulser and a current tracer. (6 marks)

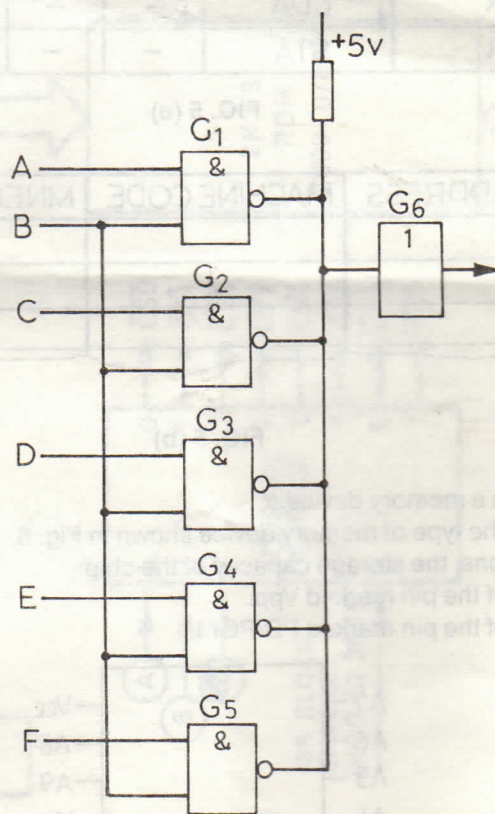


FIG. 7

- 13 a) Explain why, once manufactured, a dedicated microcomputer device can only be used for the purpose for which it was originally designed. (4 marks)
- b) Show with the aid of a diagram, how a dedicated microcomputer may be used to control a domestic central heating system. (6 marks)

- 14 Refer to Fig. 8 which shows a floppy disk drive mechanism.
- (a) State the function performed by EACH part A, B and C. (6 marks)
- (b) Explain the use of the sensors D and E. (4 marks)

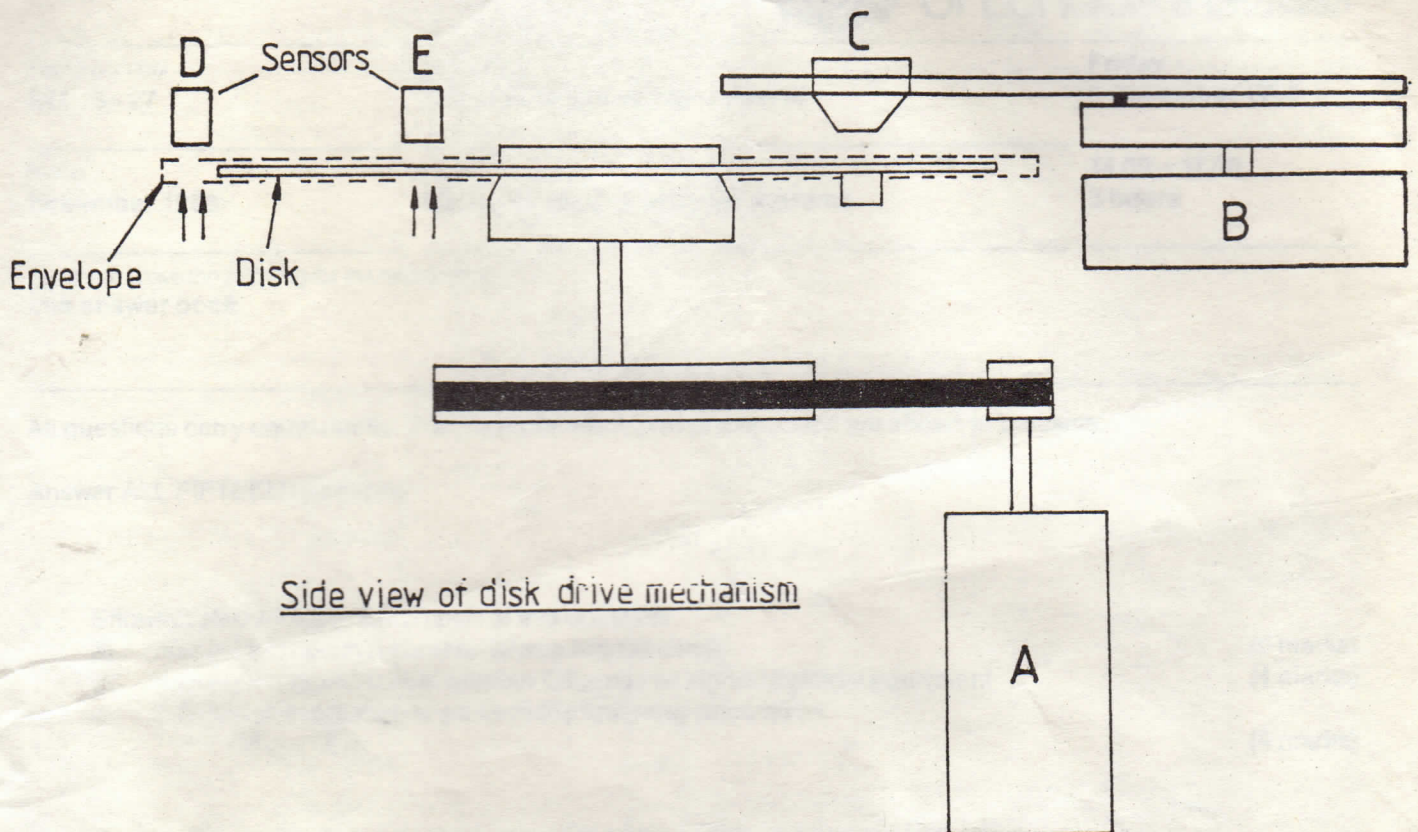


FIG. 8

- 15 (a) Explain with the aid of a diagram, the principle of using an interrupt as a means of communication between an MPU and a peripheral device. (4 marks)
- (b) State the main advantage of using an interrupt rather than programmed (polled) I/O as a means of communication between an MPU and a peripheral device. (2 marks)
- (c) Explain briefly how 'direct memory access' (DMA) may be used for very fast data transfers between a microcomputer and a peripheral device. (4 marks)

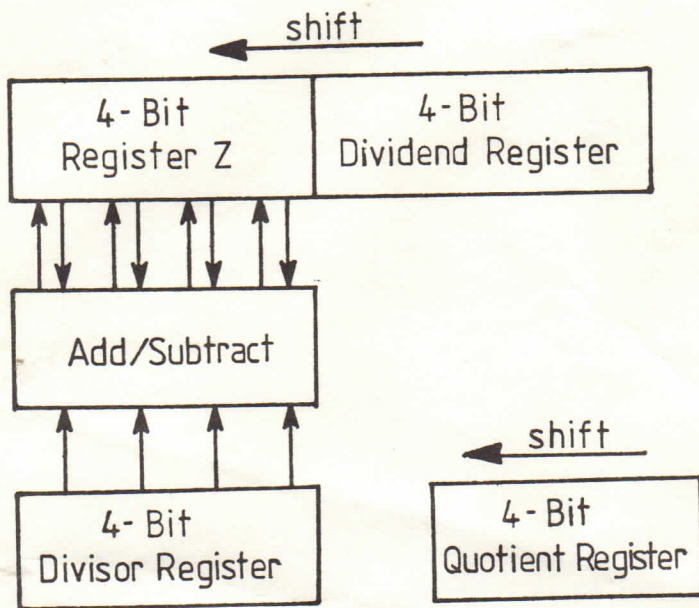


FIG. 1(b)

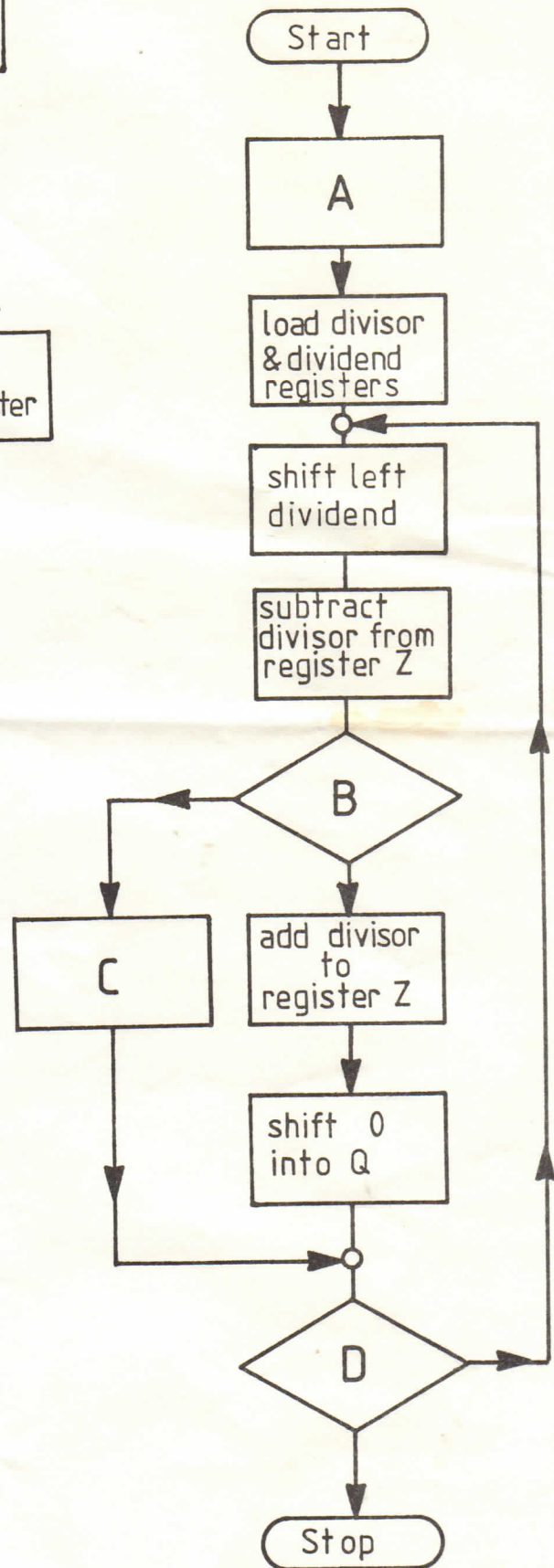


FIG. 1(a)