

## Computer Architecture and Organization Laboratory

### Department of Computer Science and Technology, IEST

#### Experiment No: 4 (Swapping contents of registers using microprogram)

**Objective:** To become familiar with

- a) Register level data transfer through common bus, and
- b) Microprogrammed realization of the register level data transfer.

**Utilize:** 1. D latches/registers - 3 nos. 2. Counter. 3. Memory/RAM.

**The design**

The  $\mu$ -programming is a method of designing control unit in which control signal selection and sequencing information is stored in a ROM/RAM. The control signals to be activated at time  $t$  are specified by a  $\mu$ -instruction. A sequence of  $\mu$ -instructions related to a task is the  $\mu$ -program. In the present design, the  $\mu$ -program is stored in memory/RAM. The following steps are to be taken in realizing the objective.

**(i) Setting registers and control switches (manually) to realize swapping of data:**

1. Realize registers A, B and T with D latches/registers as in Figure (a).
2. Set the switches (control signals)  $C_1$ ,  $C_2$ , and  $C_3$  to realize data swap.
3. Identify additional control signals required to realize swapping through common bus.

**(ii) Automated swapping of data:**

1. Realize bi-directional bus (Figure (b)).
2. Identify the control signals required to realize the following sequence of  $\mu$ -instructions
  - a) Copy  $T \leftarrow A$
  - b) No operation
  - c) Copy  $A \leftarrow B$
  - d) No operation
  - e) Copy  $B \leftarrow T$

**(iii) Setting up control memory:**

1. Write  $\mu$ -instructions in memory. Generate memory address using counter. Supply clock to generate next addresses (Figure (c)).
2. Run  $\mu$ -program.

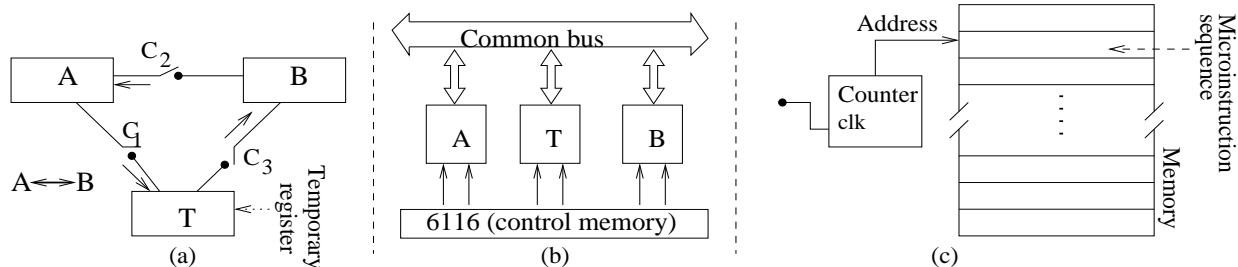


Fig. 1. Circuit diagram