



The University of Zambia

School of Engineering

Department of Electrical and Electronic Engineering

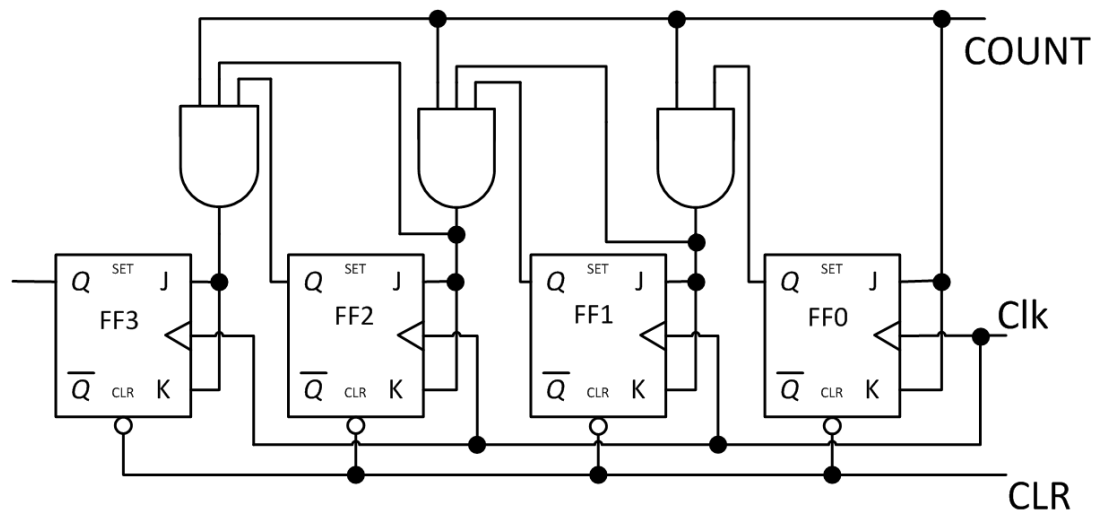
EEE 3131 - Digital Electronics

Assignment 6-7-8

Due Date: 11-05-2016

1. On Registers and Counters:

- a) Answer the following and make sure you include a brief explanation.
  - i. How many flip-flops are used to make a MOD-32 binary counter? [2 Marks]
  - ii. A MOD-16 ripple counter has is at value  $1001_2$ . What value will it have after 30 clock pulses? [4 Marks]
  - iii. What advantage does the synchronous counter have over the asynchronous counter? [2 Marks]
  - iv. What is the terminal count of a MOD-12 counter? [2 Marks]
  - v. For the counter below, draw the timing diagram for 16 clock cycles. Your timing diagram should show the waveforms for  $Q_0$ ,  $Q_1$ ,  $Q_2$ ,  $Q_3$ . Also mention what states COUNT and CLR should be in as the counter is being used for counting. [10 Marks]



- b)
- i. Draw a simple 2-bit buffer register without any input or output control. **[5 Marks]**
  - ii. Improve your register in (i) above by adding control at the input so that data can be written to the registers when needed; and when not in writing mode, the register should be able to refresh its contents? **[5 Marks]**
  - iii. What would you use to ensure that the output is also controlled in such a manner that you can only read from the register when there is a read signal? Include this in your diagram to further improve your 2-bit register for connection to a data bus. **[5 Marks]**
  - iv. After you have added control to the input and the output of your register, show how it can be connected to a common data bus and how both writing and reading can be done to and from the same bus. **[5 Marks]**

## **2. On Memories and Microprocessor Architecture:**

- a) In a few lines, compare ROM, PROM, EPROM and EEPROM in terms of ease of writing to them and ease of erasure. **[8 Marks]**
- b) Considering volatile memory, compare static and dynamic memory in terms of implementation and advantages/disadvantages. **[6 Marks]**
- c) What is the main difference between a microcontroller and a microprocessor? **[2 Marks]**
- d) List two examples of microcontrollers. **[1 Mark]**
- e) List the three buses used in computer systems and their functions. **[3 Marks]**