

# CPE 2211 COMPUTER ENGINEERING LAB

## EXPERIMENTS 13 LAB MANUAL

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### GENERAL SEQUENCE COUNTER

#### OBJECTIVES

In this experiment you will

- Design and build a general sequence counter with JK-Flip Flops

#### LAB REPORTS

The format of lab reports should be such that the information can be used to reproduce the lab, including what values were used in a circuit, why the values were used, how the values were determined, and any results and observations made. This lab manual will be used as a guide for what calculations need to be made, what values need to be recorded, and various other questions. The lab report does not need to repeat everything from the manual verbatim, but it does need to include enough information for a 3<sup>rd</sup> party to be able to use the report to obtain the same observations and answers. Throughout the lab manual, in the Preliminary (if there is one), and in the Procedure, there are areas designated by **Qxx followed by a question or statement**. These areas will be **bold**, and the lab TA will be looking for an answer or image for each. These answers or images are to be included in the lab report. The lab TA will let you know if the lab report will be paper form, or if you will be able to submit electronically.

#### REFERENCES

Givone: Sections 4.4 – 4.6

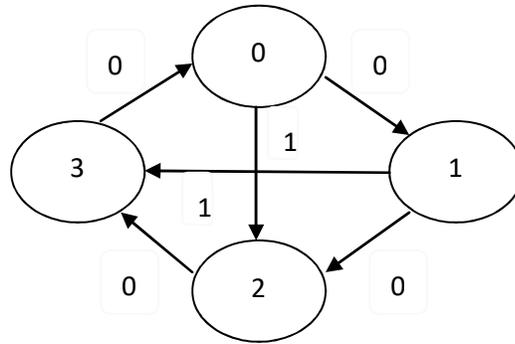
#### MATERIALS REQUIRED

Quartus II and ModelSim

#### PRELIMINARY

A simple sequence counter is shown in Figure 1. Design the counter shown in Figure 1 with the following steps:

1. 1) Write a state transition table with the input ( $X$ ), current state ( $Q_2Q_1$ ), and next state ( $Q_2^*Q_1^*$ ).
2. Find out the JK flip-flops corresponding to the transition table.
3. Write minimal logic expressions for  $J_2$ ,  $K_2$ ,  $J_1$ , and  $K_1$  using either a sum-of-products (SOP) or a product-of-sums (POS) (considering the unused states as don't care).
4. Draw a logic diagram for your SOP or POS expression.



*Figure 13: State Diagram of the General Sequence Counter.*

## **PROCEDURE**

1. Build your design from the Preliminary using SSI components.
2. Test all state transitions for your design to verify that it behaves exactly as desired.