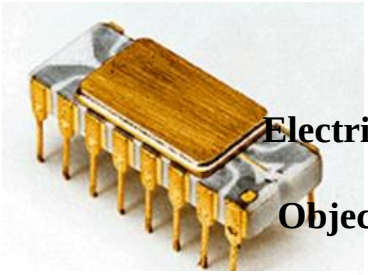


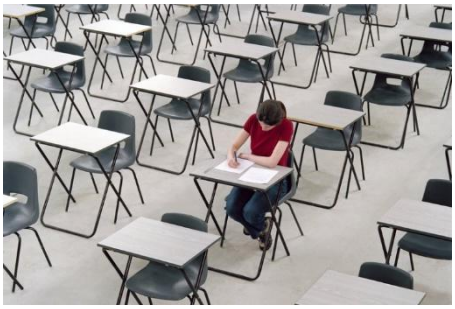
The first microprocessor, Intel 4004, 2250 transistors, 108Khz, 1971.

UNIVERSITY OF TEHRAN
Electrical and Computer Engineering Department
ECE (8101) 432
Object Oriented Modeling of Electronic Circuits
Spring 96-97
Midterm Exam

First Name: _____

Last Name: _____

Number: _____



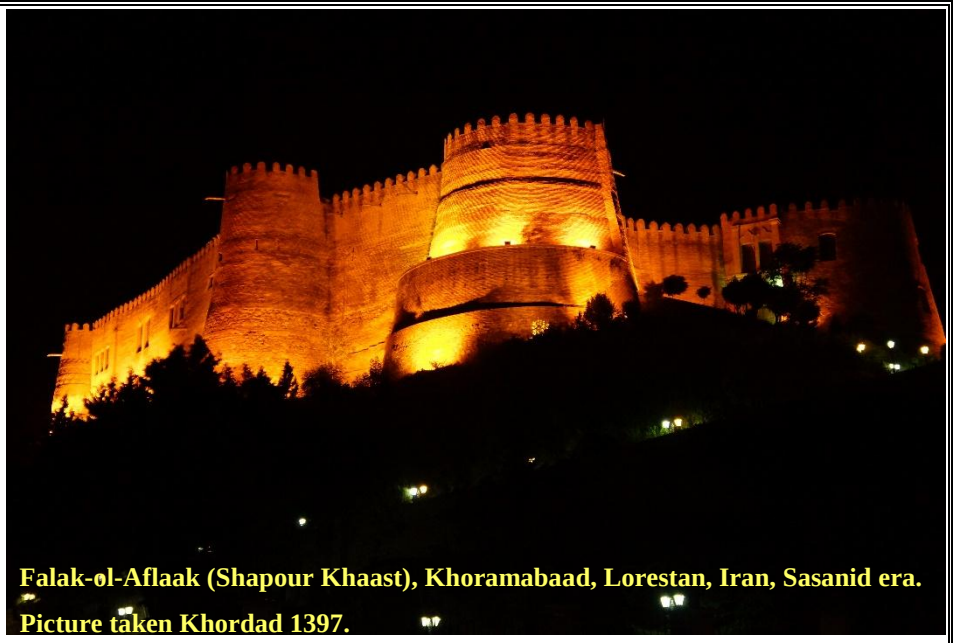
Grade:

Problem 1. _____/ 25

Problem 2. _____/ 25

Problem 3. _____/ 25

Problem 4. _____/ 25



Falak-ol-Aflaak (Shapour Khaast), Khoramabaad, Lorestan, Iran, Sasanid era. Picture taken Khordad 1397.

Total: _____/ 100

Regulations:

* DO NOT USE LAPTOPS
* EXTRA SHEETS WILL NOT BE ACCEPTED
* THIS IS AN OPEN NOTE OPEN SLIDE EXAM
* YOU MUST SHOW COMPLETE WORK ON ALL PROBLEMS
* YOU HAVE EXACTLY 165 MINUTES FOR WORKING ON THIS TEST
* WHERE CODES REPEAT, USE OFG THREE DOTS IS ALLOWED TO IMPLY REPEATITYION

YOU ARE TRUSTED AND BY SIGNING HERE YOU ARE INDICATING THAT THIS EXAM IS YOUR OWN WORK ONLY: Signature:

1. **A)** Show state diagram for a circuit that receives 2-bit binary inputs A_1A_0 and calculates the remainder of all data ever received when divided by 5. The remainder appears on $R_2R_1R_0$ outputs. These same output values become the state assignment for the five starts of the machine. **B)** Use a ROM and a 3-bit register to implement the circuit of Part A. Show ROM contents at addresses that are formed by the present state and the 2-bit inputs. Use A_1A_0 for the least significant bits of the address. **C)** Show SystemC description of this state machine. Provide an asynchronous reset.

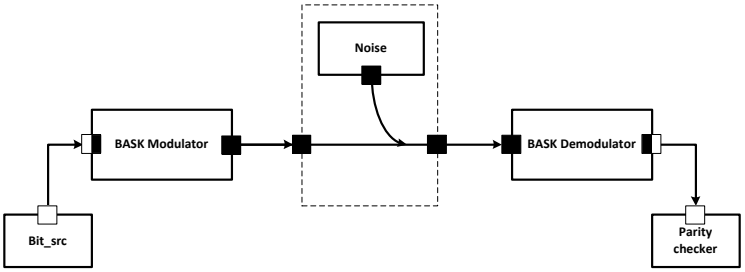
2. In this problem, you should change the BASK Modulator and Demodulator system in order to test it in a real situation. Insert an LSF module between the BASK Modulator and Demodulator. This module injects a noise signal to the output of BASK modulator (see figure below). The noise is a sine wave with a frequency lower than the carrier signal's frequency. The noise signal is zero at random times.

A) Write an LSF module that injects a noise signal to the output of the BASK Modulator.

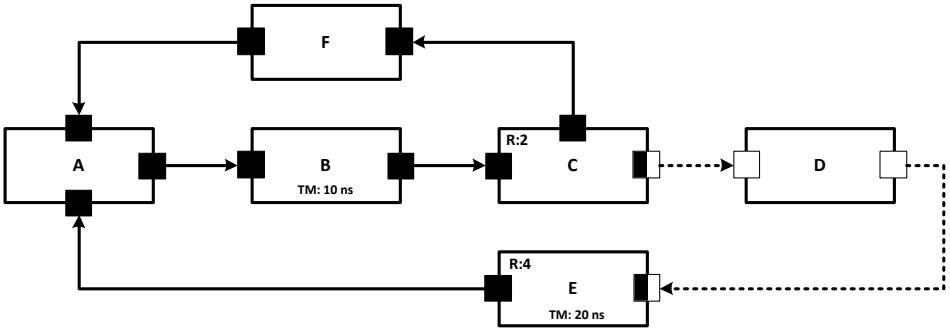
B) Modify the *Bit_src* module in the BASK Modulator side in order to produce an odd parity of seven bits and send the parity as the 8^{th} bit of the sequence.

C) Write a discrete-event module that takes the output of the BASK Demodulator and checks the parity bit and the correctness of the received data.

D) Put all modules together and write a main module to test the complete system.



3. Consider the cluster of modules shown in figure shown below. Define the time steps of all modules using the time step propagation rule. Find the conflict situation if there is any. Define time step, rate and delay attributes for all ports. Define a static schedule for the cluster. (Module D is a discrete event module).



4. Write an ELN module for the following circuit in SystemC-AMS. Use the same rates for input and output. Input of this module is from a TDF module and its output goes to an LSF module.