



ECE DEPARTMENT, NITR

Mid-Semester Examination, Spring 2012

Course Title: Embedded Computing Systems

Maximum Marks: 60 Course id: EC 624/424 Time: 2 Hours

(Answer all the questions. Figures in the right hand margin indicate marks. Brevity without cut down of major content is welcome. Symbols used throughout carry usual meaning. State assumptions clearly in choosing any component value or data if not specified)

1.

[1 × 7]

- What is the advantages and risks in using open source RTOS?
- Given that cost of a poll is 400 clocks and CPU is 500 MHz; how much of the CPU is needed to poll for a mouse that requires 30 polls per second?
- List and explain briefly three main characteristics of an embedded system that distinguish such systems from other computing systems?
- At what stage of design methodology would we choose a programming language and test our design for functional correctness.
- OS functions as a Transformer and also as an Effective Scheduler. How?
- Briefly describe the distinction between Requirements and Specification.
- Briefly describe the distinction between Specification and Architecture

2.

[5 × 3]

- Bring out the differences between GPOS and RTOS
- Consider three periodic tasks with priorities, periods and execution time as given in Table: 1. Draw Gantt Charts corresponding to how these tasks will be scheduled, assuming that all the jobs have same release time. Schedule the tasks to meet their deadlines with pre-emption.
- Sketch a block diagrammatic representation of spiral model used for embedded system design life cycle. Briefly explain. Compare the advantages vis-à-vis disadvantages of this model with waterfall model

Table:1

Tasks	Priority	Period	CPU burst
T1	1	7	2
T2	2	17	4
T3	3	24	8

3.

[8]

Draw a class diagram for the classes required in a basic microwave oven. The system should be able to set the microwave power level between 1 to 9 and time a cooking run up to 59 minutes and 59 seconds in one-second increments. Include * classes for the physical

interfaces to the telephone line, microphone, speaker and buttons. Draw a collaboration diagram for the microwave oven. The diagram should show the flow of messages when the user first sets the power level to 7, then sets the timer to 2:30, and then runs the oven.

4.

a) What is a single-purpose processor? What are the benefits of choosing a single-purpose processor over a general-purpose processor? [3]

b) What is data path and what are the various units of a data path?

Design a dedicated data path for a processor which will perform the up-counting of a 4-bit input data as shown in Fig.1. [6]

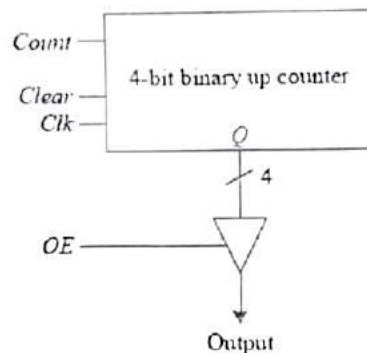


Fig.1. 4-bit Up-Counter

c) Write down a summation algorithm to add the numbers from n down to 1, where " n " is an input number. Construct a FSM with a minimal set of states for the above summation algorithm. [6]

5.

a) What are the various aspects of selecting a microprocessor for an embedded system? [3]

b) Describe with an example how pipeline helps in increasing throughput of a system? Assuming 1 clock per stage, what is the latency of an instruction in a 5 stage machine? What is the throughput of this machine? [5]

c) Discuss the various issues related to design of a microprocessor. Discuss briefly about the design of the control unit and data path of a microprocessor which is used to manipulate 16-bit data. [7]

Best of luck