

PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Midterm Examination : Semester II

Academic Year : 2004

Date : 20 December 2004

Time : 13.30 - 15.30

Subject : 217-452 Real-time Software

Room : A401

Attempt all questions.

1.

- (a) Detail the differences between traditional computer applications and real-time systems. (4)
- (b) Describes the environmental and performance requirements of embedded real-time systems. (3)
- (c) Describes typical structures of modern microprocessor-based equipment. (3)

2.

- (a) What, in general terms, does an RTOS perform? (2)
- (b) Why do we use real-time operating systems? (2)
- (c) What are the benefits and drawbacks of an RTOS? (2)
- (d) Show four features of a typical RTOS. (4)

3.

- (a) Explain and show section of codes how to create tasks in uC/OS. (2)
- (b) Explain and show section of codes how to synchronize tasks in uC/OS. (2)
- (c) Explain and show section of codes how to handle shared-data problems in uC/OS. (2)
- (d) Explain and show section of codes how to handle critical regions in uC/OS. (2)
- (e) Explain and show section of codes how to do "OS Hook" in uC/OS. (2)

4. The underground tank monitoring system monitors two underground tanks by reading thermometers and levels of floats installed in each tank. To read a float and thermometer in one of the tanks, the PC must send, via serial ports, a command to the hardware to tell it which sensors in the tanks to read from. Since gasoline expands and contracts substantially with changes in temperature, the system must use both the temperature and the float level to calculate the number of gallons of gasoline in a tank.

The system must monitor the level in each tank periodically, and it must flag as leaking any tank in which the number of gallons drops slowly and consistently over a period of hours. The system must pay special attention to tank in which the level is rising rapidly and set off the alarm if such a tank gets close to full and the level is still rising. Overflows can happen quickly when a tanker truck is refilling an underground tank.

The user interface consists of a PC keyboard, a PC screen, and a dot-matrix printer.

Question: Design the software for the underground tank monitoring system by dividing the work of the system into individual tasks. Show the details of each task, inter-task communication, and task synchronization. (10)

K. Thongnoo