Faculty of Computers & Information
Fourth Year, CS department
Embedded Systems
Instructor: **Dr. Anas Youssef**

Midterm Exam
Time: **1 hour**
Number of Pages: **2**
Total marks: **20**

Student Name	
Student Section No.	

Question 1: (8 Marks)

(a) What does **ASIC** stand for in an embedded system architecture?

(b) Briefly describe the difference between a **critical hard-realtime** system and a **non-critical hard-realtime** system. State **one** example for **each** of them.

(c) Draw a simple diagram that shows the behavioral specification of **an embedded system that controls an ATM machine** with at **least four different states.**

(d) Write a sample **pseudocode** that implements a **power-saving super loop** for a sequence of tasks that are performed in an embedded system.

Question 2: (12 Marks)

(a) Briefly describe the purpose of having a **Realtime Kernel** in building an embedded system.

(b) Draw a diagram that shows a **hardware/software co-design methodology** for an embedded system.

(c) **Briefly** describe difference between the **priority inversion** problem and the **unbounded priority inversion** problem that may occur in processor scheduling of tasks in **real time embedded systems**. Which of the two problems has more critical effect on missing task deadlines? **Justify with reasons.**

(d) Consider the following set of periodic real-time tasks with the following execution profiles: **Task T1** execution time is **50 ms** and execution rate is **10 hz, Task T2** execution time is **100 ms** and execution rate is **8 hz** and **Task T3** execution time is **150 ms** and execution rate is **5 hz.**

(i) Can the three tasks be successfully scheduled using **perfect scheduling**? **Why**?

(ii) Suppose that the first instance of each of the **three** tasks arrives at time $t = 0$. Assume that the **deadline** for each task **is less than its corresponding execution period by 10%**. Draw a timing diagram that uses **rate monotonic scheduling** to show the steps of task scheduling over time. Will **all** the tasks' deadlines be met or not? **Why**?