Faculty of Computers & Information
Special Program in Software Engineering
Embedded and Realtime Systems
Instructor: **Dr. Anas Youssef**

Midterm Exam
Time: **1 hour**
Number of Pages: **1**
Total marks: **25**

Question 1: **(10 Marks)**

(a) List **four** different components that can be found in a typical embedded system.

(b) Describe by **sample applications** the difference between the following three types of events: **synchronous**, **asynchronous,** and **isochronous** events.

(c) Any embedded system requires what is called a **firmware**. What is the purpose of such software in any embedded system?

(d) Draw a simple diagram that shows the behavioral specification of **an embedded system that controls an elevator in a building** with at **least three different states**.

Question 2: **(15 Marks)**

(a) Briefly describe the meaning of **system synthesis** in the context of an embedded system design.

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

(c) List **three different levels** of **hardware abstraction** that can be used when designing an embedded system.

(d) When designing an embedded system, the designer might be concerned with optimizing some design criteria like **schedulability**. Briefly describe what is meant by this design criteria?

(e) Suppose you want to design an embedded system with the objective to optimize the following three design criteria: **safety**, **reliability**, and **performance**. Each of the three design criteria is assigned a weight out of 10 as shown in **Table 1**. You also have two proposed design alternatives to design the system. The two design alternatives are named: DA1 and DA2. Each of the two design alternatives is assigned a score out of 10 for each design criterion as shown in **Table 2**. Construct a **design tradeoff spreadsheet** for the two proposed design alternatives and use this sheet to decide which of the two design alternatives will be more efficient to optimize the three required design criteria.

Table 1

Design Criterion	Weight (10)
Safety	8
Reliability	5
Performance	3

Table 2

Design Alternative/Design Criterion	Safety (10)	Reliability (10)	Performance (10)
DA1	5	9	6
DA2	8	3	2