



Full Name : _____ Student ID: _____

Grade Table (for Lecturer use only)

Question	Points	Score
1	20	
2	10	
3	10	
4	40	
5	20	
Total:	100	

Instructions for Midterm Exam

Welcome to the midterm exam of EEE423 - Embedded Systems and good luck!

Please read the following rules and confirm by signing that you have read and understood the rules before you receive your exam:

- The midterm exam shall be conducted between 15:15 and 16:45. Exam duration is 90 minutes. Students must finalise the exam by delivering it before 16:45. Students are not allowed to leave the exam in the first 30 minutes.
- Student ID cards shall visibly be on the edge of desks till the end of the exam. Students without the student ID cards or Turkish identity cards shall not be participated into the exam.
- This is a closed-book exam which means that students are not allowed to take notes, books, or any other reference material into the exam. Throughout the exam, students shall not possess mobile phones and electronic devices that are capable of storing, receiving or transmitting information or electronic signals, such as computerised watches.
- Students are not allowed to take a glance at the exam questions until told to do so. Students shall not communicate with any other student under any circumstances during the exam period. A student, who cheats, tries to cheat during the exam, or is identified to be cheating after investigating exam documents, is given 0 (zero) for that exam and a disciplinary investigation is opened against the student.
- An incorrect answer to a question is awarded no marks with no consideration of any partial credit. Therefore, no partial credit will be given.

In recognition of and in the spirit of the above rules which constitute Adana Alparslan Türkeş Science and Technology University Honour Code, I certify that I will neither give nor receive unpermitted aid on this examination.

Signature: _____



1. Answer the following questions.

(a) **(5 points)** Define an embedded system and list its three characteristics.

(b) **(2 points)** What are the names of the programming language and integrated development environment (IDE) used for the embedded system set in this course?

- Programming Language:
- IDE:

(c) **(2 points)** What are the names and models of the embedded system set and the processor that are used throughout this course?

Embedded System Set

- Name:
- Model:

Processor

- Name:
- Model:

(d) **(2 points)** According to ChatGPT, assembly language is crucial for embedded systems for several reasons. List any two of those reasons.

(e) **(3 points)** Please tick (✓) the correct option for each row.

	CISC	RISC
Provides a very few number of addressing modes.	<input type="checkbox"/>	<input type="checkbox"/>
Provides a large number of addressing modes.	<input type="checkbox"/>	<input type="checkbox"/>
Has a micro-programmed unit with a control memory.	<input type="checkbox"/>	<input type="checkbox"/>
Has a hard-wired unit without a control memory.	<input type="checkbox"/>	<input type="checkbox"/>
Has an easy compiler design.	<input type="checkbox"/>	<input type="checkbox"/>
Has a complex compiler design.	<input type="checkbox"/>	<input type="checkbox"/>

(f) **(3 points)** Fill in the blanks in the following sentences.

..... embedded systems are the combination of physical objects and embedded systems technology that enable them to connect and to with each other and the internet. These systems consist of sensors, microcontrollers, and protocols that facilitate data collection, processing, and transmission.



(g) (3 points) Please tick (✓) the correct option for each row.

	Counter	Timer
The register is incremented for every machine cycle.	<input type="checkbox"/>	<input type="checkbox"/>
The register is incremented considering 1 to 0 transition at its corresponding to an external input pin (T_0 , T_1)	<input type="checkbox"/>	<input type="checkbox"/>
Maximum count rate is $\frac{1}{24}$ of the oscillator frequency.	<input type="checkbox"/>	<input type="checkbox"/>
Maximum count rate is $\frac{1}{12}$ of the oscillator frequency.	<input type="checkbox"/>	<input type="checkbox"/>
Uses the frequency of the internal clock and generates delay.	<input type="checkbox"/>	<input type="checkbox"/>
Uses an external signal to count pulses.	<input type="checkbox"/>	<input type="checkbox"/>

2. State the term, symbol, or expression that is best described by each definition.

(a) (1 point) A property of RAM such that data is lost if power is removed and then restored.

Answer: _____

(b) (1 point) The name given to describe 1,024 (2^{10}) bytes.

Answer: _____

(c) (1 point) A collection of wires in a computer that allows data to travel from one module to another within the computer.

Answer: _____

(d) (1 point) A last in first out data storage system on the computer used to remember data temporarily.

Answer: _____

(e) (1 point) This C/C++ operator is used in if-then while-loop and do-while-loops for checking to see if two numbers are equal.

Answer: _____

(f) (1 point) The name given to describe 1,000 (10^3) bytes.

Answer: _____

(g) (1 point) A type of logic where the voltage representing false is less than the voltage representing true.

Answer: _____



- (h) **(1 point)** A drawing that describes the sequence of operations of software, defining what and when software actions will occur.

Answer:_____

- (i) **(1 point)** This C/C++ operator is used in if-then while-loop and do-while-loops for checking to see if two numbers are not equal.

Answer:_____

- (j) **(1 point)** A property of ROM such that data is not lost if power is removed and then restored.

Answer:_____

3. Answer the following questions.

- (a) **(2 points)** What is the decimal value of the unsigned four-digit octal number 1036?

Answer:_____

- (b) **(1 point)** If you add an n -bit signed number to an m -bit signed number what is the maximum number of bits in the sum? (Assume $n \geq m$)

Answer:_____

- (c) **(1 point)** If you multiply an n -bit unsigned number to an m -bit unsigned number what is the maximum number of bits in the product? (Assume $n \geq m$)

Answer:_____

Assume the value is 8 bits. The binary is 10010010.

- (a) **(2 points)** What is the value as unsigned hexadecimal?

Answer:_____

- (b) **(2 points)** What is the value as unsigned decimal?

Answer:_____

- (c) **(2 points)** What is the value as signed decimal?

Answer:_____



4. Consider the following 8-bit subtraction (assume registers are 8 bits wide)

Load 0x1F into R2
Load 0xC0 into R1
Subtract R3 = R2 - R1

(a) (10 points) What is the 8-bit result in Register R3 (in hexadecimal)?

Answer:_____

(b) (10 points) What is the 8-bit result in Register R3 (as an unsigned decimal)?

Answer:_____

(c) (10 points) What is the 8-bit result in Register R3 (as a signed decimal)?

Answer:_____

(d) (5 points) What is the value of the C bit?

Answer:_____

(e) (5 points) What will be the value of the V bit?

Answer:_____

5. (20 points) Develop a C/C++ function named as *findroot* that firstly requests coefficients of a quadratic function ($ax^2 + bx + c = 0$) from the user, then calculates Δ ($\Delta = b^2 - 4ac$) and finally computes the roots $x_{1,2}$ ($x_{1,2} = \frac{-b \pm \sqrt{\Delta}}{2a}$).

Hint:

- If $\Delta > 0$, there shall be two real roots x_1 and x_2 ;
- Else if $\Delta = 0$, there shall be only one real root owing to $x_1 = x_2$;
- Else, there shall be no real root.