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Family Name					
Given Name/s					
Student Number					
Teaching Period	Semester 1, 2018				

HIT332 – Embedded and Mobile Systems	DURATION	
	Reading Time:	10 minutes
	Writing Time:	180 minutes
INSTRUCTIONS TO CANDIDATES		
<p>1.1 The examination has twenty (2) questions. 1.2 Answer all questions. 1.3 Note that questions ARE NOT of equal value. 1.4 Read ALL questions carefully.</p>		
EXAM CONDITIONS		
<p><u>You may begin writing from the commencement of the examination session.</u> The reading time indicated above is provided as a guide only.</p>		
This is a RESTRICTED OPEN BOOK examination		
Any non-programmable calculator is permitted		
No handwritten notes are permitted		
Any hard copy, unannotated English dictionary is permitted		
ADDITIONAL AUTHORISED MATERIALS	EXAMINATION MATERIALS TO BE SUPPLIED	
Lecture Notes (Unannotated) Lecture Textbook/s (Unannotated)	1 x 20 Page Book 1 x Scrap Paper	

**THIS EXAMINATION IS PRINTED
DOUBLE-SIDED.**

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Question 1 (6 marks)

Question 1.1 (3 marks)

How does Moore's law affect the design metrics of embedded systems?

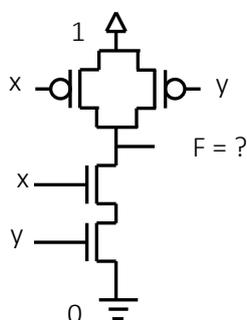
Question 1.2 (3 marks)

Explain how the different design metrics can compete with each other.

Question 2 (5 marks)

Question 2.1 (3 marks)

The logic gate shown below consists of nMOS and pMOS transistors. Write the truth table of this gate.



Question 2.2 (2 marks)

What type of gate is the gate above? Is it often used?

Question 3 (6 marks)

Question 3.1 (2 marks)

What are the two main characteristics of memory?

Question 3.2 (4 marks)

Discuss the properties of both mask-programmed ROM and SRAM which put these types of memory at the extremes of the two main memory characteristics.

Question 4 (5 marks)

Question 4.1 (3 marks)

Why can we not connect a stepper motor directly to the output of a general purpose micro-controller? List two ways that we can control a stepper motor from a general purpose micro-controller.

Question 4.2 (2 marks)

A pulse width modulator has a duty cycle of 75%. What does this mean?

Question 5 (4 marks)

Draw a diagram of how you might compose several 1K x 8 ROMs into a 4K x 16 ROM.

Question 6 (5 marks)

Question 6.1 (2 marks)

Explain the differences between port-based I/O and bus-based I/O.

Question 6.2 (3 marks)

How can the number of ports on a 4-port 8051 be extended to 8?

Question 7 (3 marks)

Give two examples of error detection methods used in embedded systems design.

Question 8 (5 marks)

Question 8.1 (3 marks)

Which of the basic stages of instruction execution would take most time? Why?

Question 8.2 (2 marks)

How can the speed of instruction execution be increased?

Question 9 (6 marks)

Question 9.1 (3 marks)

What is the difference between maskable and non-maskable interrupts?

Question 9.2 (3 marks)

Give an example of a situation when it would be preferable to use a maskable interrupt.

Question 10 (6 marks)

Question 10.1 (3 marks)

Give a short description of the basic architecture of a general purpose processor.

Question 10.2 (3 marks)

What is the difference between Harvard architecture and Princeton (von Neumann) architecture?

Question 11 (3 marks)

In what ways can a program, intended for an embedded system be tested?

Question 12 (8 marks)

Question 12.1 (2 marks)

What is the purpose of image compression?

Question 12.2 (3 marks)

JPEG encoding provides for two methods of compression. Briefly (in a few sentences) explain the essence of each of these methods.

Question 12.3 (3 marks)

How does each of the methods mentioned above affect the quality of the image?

Question 13 (3 marks)

List three things you need to know before you can write program for a micro-processor using assembler?

Question 14 (3 marks)

List three requirements of real time systems and briefly describe each.

Question 15 (7 marks)

Question 15.1 (4 marks)

What design metrics should be considered in order to make a good choice between a general purpose processor and a custom single purpose processor?

Question 15.2 (3 marks)

Are there any advantages of using both single purpose processors and a general purpose processor in a single embedded system? Explain your answer.

Question 16 (4 marks)

Is USB a serial or a parallel communication protocol? Under what circumstances is serial communication a better option than parallel communication?

Question 17 (6 marks)

Question 17.1 (3 marks)

Explain what is meant by “daisy-chain arbitration”.

Question 17.2 (3 marks)

If five peripherals, which are equally important, need to be serviced what would be best, using the daisy-chain arbitration method or using a priority arbiter? Justify your answer.

Question 18 (3 marks)

You have graduated from CDU and you are now an Embedded Systems Consultant. One of your clients wants to know whether he should use direct memory access in their project or not. What questions would you ask your client in order to give useful advice?

Question 19 (4 marks)

Question 19.1 (2 marks)

List in order of importance, the design metrics that are affected by the use of cache.

Question 19.2 (2 mark)

Is EPROM a suitable memory choice for cache? If yes, explain why. If no, explain why not.

Question 20 (8 marks)

Research conducted at Charles Darwin University shows that it is possible to diagnose some problems with peoples hearing by playing sounds to them through headphones and recording electrical signal generated in the brain as a response to these sounds. To get effective information, the sound must be played to the person many times, sometimes in phase, sometimes out of phase, and the signals processed after each test. These signals must be sampled quickly and each sample is many thousands of data points long. These samples are then processed using various digital signal processing techniques before any hearing issues can be identified.

It is intended that the research be developed into a piece of self-contained diagnostic equipment. This equipment would have an embedded system at its centre that plays the sounds, records the electrical signals and then process the results so that they can be displayed on a screen for the medical professional to interpret.

Question 20.1 (4 marks)

Briefly describe your approach to designing the described embedded system system.

Question 20.2 (4 marks)

List the technical considerations for this system related to:

- processor(s)
- memory
- peripherals