

Name: _____ ID#: _____

Please read through the *entire* examination first! This exam was designed to be completed in 50 minutes. There are 2 problems for a total of 100 points (the second problem is composed of 3 parts). The point value of each problem is indicated in the table below. There will be partial credit, so do make sure to get to every problem.

Each problem is on a separate sheet of paper. Write your answer *neatly* in the space provided. Do not use any other paper.

Good luck.

Problem	Max Score	Score
1	30	
2 – Part I	20	
2 – Part II	35	
2 – Part III	15	
TOTAL	100	

1.

(30 points)

Define the following terms related to features of your Atmega16 microcontroller and provide an example of when each feature would be used. Make SURE to relate your examples to the projects you worked on for Labs 3 and 4, if at all possible. If not, explain why not.

a) A-to-D conversion

b) Output compare

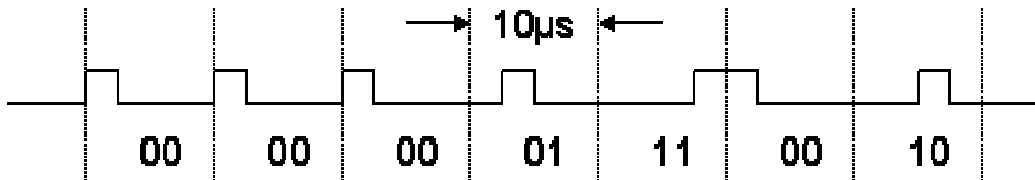
c) Memory-mapped I/O registers

d) Interrupt service routine dispatching

2.

(70 points)

Quadrature phase is a common method for encoding information. It is used in the most common infrared communication protocols (e.g., IrDA). Below is an example of a 14-bit packet of encoded data. The basic idea is that two bits of information are encoded in every cycle (between adjacent dashed lines). If the pulse is in the first fourth of the cycle then the value is 00, if it is in the second quarter it is 01, 10 for the third quarter, and 11 if the pulse is in the final fourth of the cycle. Assume that a cycle is 10 microseconds.



Part I (short answers – 20 points)

- (a) What is the shortest possible duration for the signal being high between lows? _____
- (b) What is the longest possible duration for the signal being high between lows? _____
- (c) What is the shortest possible duration for the signal to be low between highs? _____
- (d) What is the longest possible duration for the signal to be low between highs? _____
- (e) What is the maximum number of bits per second can be transmitted this way? _____

Part II (decoding – 35 points)

Write pseudo-code you would use to decode this signal. It should be possible to do entirely in interrupt service routines. Do not be concerned with syntax. In fact, you can use English (e.g., “read timer0 value”). However, you must label interrupt routines so that it is clear which condition will cause them to be executed. Make sure to describe the configuration of all devices and I/O capabilities you would use (you should only use a single timer).

Part III (discussion – 15 points)

- (a) Is it possible to look for only the rising edges during decoding? If so, why? If not, why not?
- (b) How much jitter can your approach tolerate? Please explain. Jitter is the amount by which an edge can move from its ideal position.
- a) Does your decoding approach rely on an initial pattern in the data (e.g., a preamble)? If so, why? If not, why not?