Final Exam

Name:
**SSN (last 4 digits):**

Total is 100 points.

You must show all of your work -- partial credit may be given to partially correct answers, while answers with no justification may not receive full points. Use the back of the exam sheets if you need extra space.

Any instances of cheating or copying found during the exam or during grading will be severely dealt with. You will have to leave the class if found engaging in any form of academic dishonesty during the exam.

This exam is 10 pages long and has 4 questions.

1) a) (6 pts) Briefly explain using timing diagram, Mode 1 Strobed Input mode of the 8255 Pro-
grammable Peripheral Interface.

b) (4 pts) Fill in the boxes with definitions of bit(s) for the two 8255 command bytes.

Command Byte A

7 6 5 4 3 2 1 0

| 1 | | | | | | | |

Group A

Group B

Command Byte B

7 6 5 4 3 2 1 0
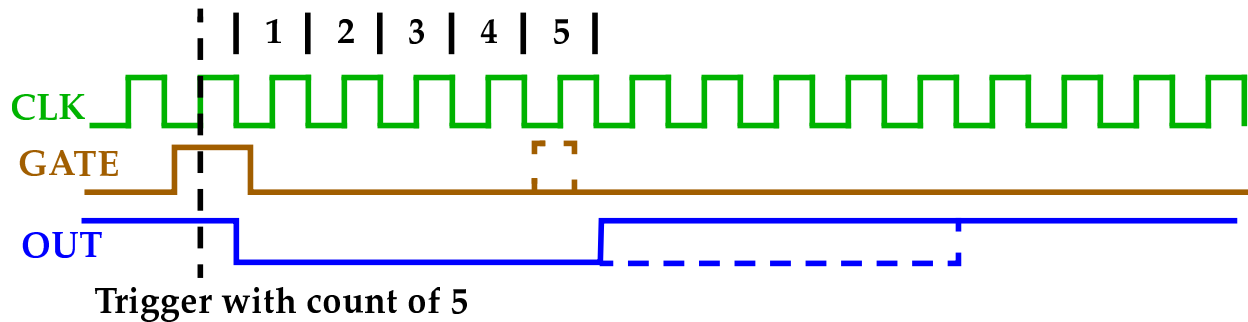
| 0 | x | x | x | | | | |
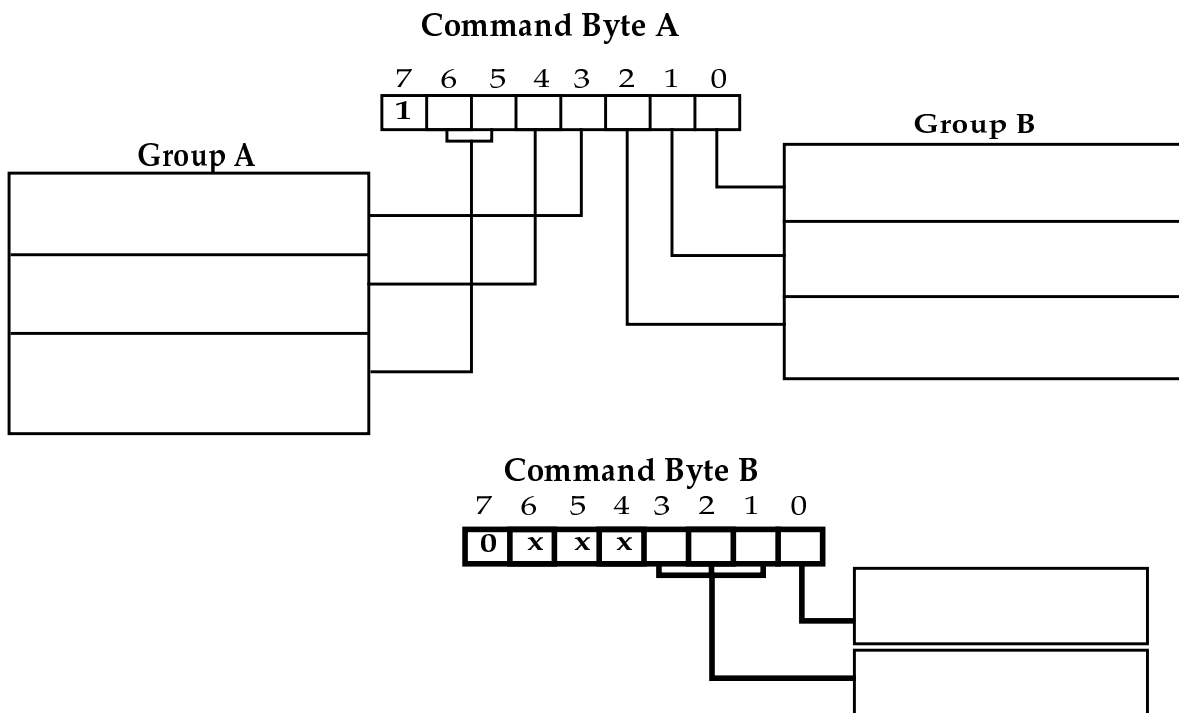
1) c) (5 pts)
i) (3 pts) Briefly explain the three basic steps for programming a keyboard interface using the 8279 Programmable Keyboard/Display Interface.

ii) (2 pts) How do you determine that a key is pressed when interfacing the keyboard with a 8279?

d) (5 pts).

Trigger with count of 5

i (3 pts) Name and briefly explain the mode of operation for the 8254 given the following timing diagram for the CLK, GATE and OUT connections of one of the counters.

ii) (2 pts) Give the timing diagram for the OUT pin given that the gate is held at 1. The 8254 is programmed in Mode 4 (software triggered one-shot) and a count of 8 is loaded.


Trigger with count of 8
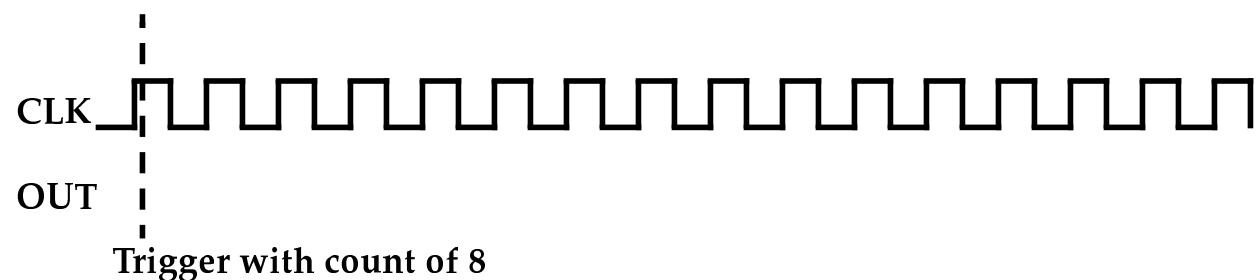
1) (e) (5 pts)
i) (2 pts) Explain the line control register and the status line register in the 16550 Programmable Communications Interface?

ii) (3 pts) List and explain briefly the types of error that can be encountered when using the 16550?

2) (a) (5 pts) Given the data stream 101001011, give the encoded data streams using the MFM and RLL encoding schemes..

```
        1       0       1       0       0       1       0       1       1

MFM


RLL

```
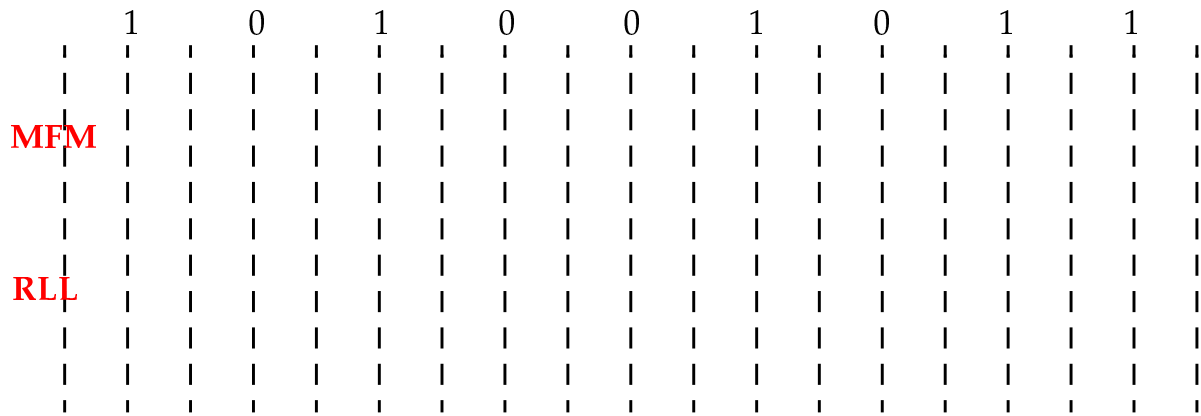
(b) (5 pts) Describe the architecture required to implement an 8-bit per pixel depth in a video card capable of displaying 256K possible colors. Be sure to include a description of the palette and the DACs.

(c) (5 pts) Compute the time available for horizontal and vertical retrace given the following data. No. of pixels per line = 640, number of raster lines = 400, Time to paint one pixel = 40ns, Horizontal time = 31.5 kHz, Vertical time = 70.1 Hz.

(d) (6 pts) List and name the different type of bus interfaces and give their data bus lengths (all possible) and maximum operational speeds or data transfer rates.

(2 pts) Briefly explain how Plug-and-Play is implemented within the PCI bus architecture.

(2 pts) Give the encoded data stream transmitted using the USB interface for the given digital data stream.

Digital Data

3) a) (5 pts) Given 4 hex data bytes: 10, 23, 45 and 04 to transmit to a receiver, compute the sum (in hex), the checksum, and the sum at the receiver.

b) (5 pts) Briefly explain the purpose of the files in /dev on a linux system with respect to device drivers.

c) (10 pts) Given data byte: **11010010**, compute the encoded data when using Hamming Codes for single error correction. Show your work.

d) (5 pts) Flip bit 8 of the encoded data above and show the procedure for correcting this bit.

4) a) (5 pts) What is the purpose of the CAS0 through CAS2 pins on the 8259A.

```
                        ┌──────────────────┐
                        │ D0          IR0  ├──
                        │ D1          IR1  ├──
                        │ D2          IR2  ├──
                        │ D3          IR3  ├──
                  VCC ○ │ D4          IR4  ├──
                        │ D5          IR5  ├──
                  10K   │ D6          IR6  ├──
                        │ D7          IR7  ├──
                        │                  │
                        │ A0               │
                        │ CS̄               │
          IORC          │ RD̄               │
          IOWC          │ WR̄               │
                        │ SP/ĒN      CAS0  ├──
          INTR          │ INT        CAS1  ├──
          INTA          │ INTA       CAS2  ├──
                        └──────────────────┘
```
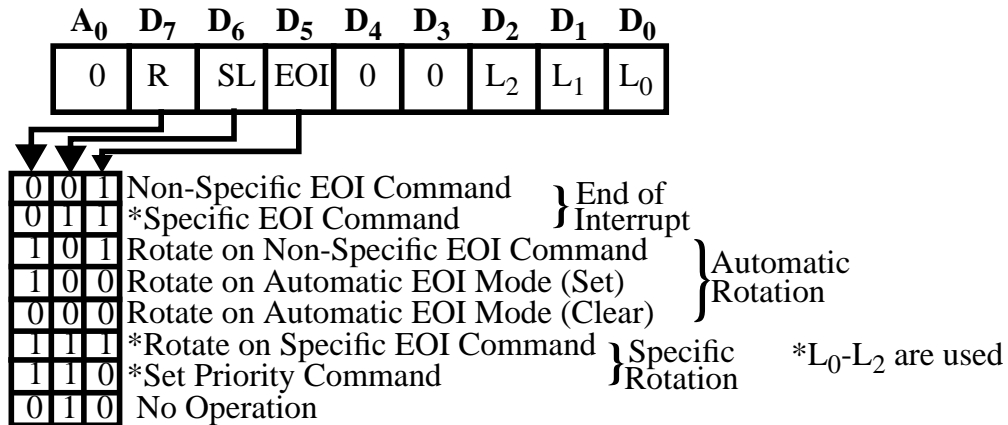
b) (10 pts).

A_0	D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
0	R	SL	EOI	0	0	L_2	L_1	L_0

0	0	1	Non-Specific EOI Command	} End of Interrupt
0	1	1	*Specific EOI Command	} End of Interrupt
1	0	1	Rotate on Non-Specific EOI Command	} Automatic Rotation
1	0	0	Rotate on Automatic EOI Mode (Set)	} Automatic Rotation
0	0	0	Rotate on Automatic EOI Mode (Clear)	} Automatic Rotation
1	1	1	*Rotate on Specific EOI Command	} Specific Rotation *L_0-L_2 are used
1	1	0	*Set Priority Command	} Specific Rotation
0	1	0	No Operation	

i) (5 pts) Briefly distinguish between Non-specific EOI and specific EOI

ii) (2 pts) Briefly explain the Set Priority Command.

iii) (3 pts) Briefly explain Rotating Priority.

c) (4 pts) List the four types of interrupts that can be generated by the 16550.

d) (6 pts) Briefly explain two alternative schemes of handling multiple hardware interrupts without using the 8259A.

EXTRA CREDIT (10 pts). Given the generator polynomial:

$$G(X) = X^{16} + X^{15} + X^2 + 1$$

and the following 16-bit data stream: 26F0H = 0010 0110 1111 0000, compute the remainder appended to the data stream using CRC error detection scheme.