CS61C Summer 2014 Discussion 15 – Dependability and I/O

Exercise 1 (Hamming Codes): Recall the basic structure of a Hamming code. Given bits $1, \dots, m$, the bit at position 2^n (starting at $n = 0$, the first bit) is parity for all the bits with a 1 in position n. For example, the first bit is chosen such that the sum of all odd-numbered bits is even.

1. Suppose you had the bits 0011 and want to add some bits to allow the correction of single-bit errors.

    a. How many bits do we have to add?

    b. Which bits are parity bits?

    c. Which bits does each parity bit cover?

    d. Write the completed coded representation for 0011.

    e. What do we need to make this into a SEC-DED code?

2. Find the original bits given the following SEC Hamming codes.

    a. 0110111

    b. 1001000

3. If we only wanted SED but not SEC, how many bits would you need to add to 4 bits? 16 bits?

Exercise 2 (RAID): Big disks are expensive (and dangerous as there is a potential for a LOT of data to be lost when disks fail). The idea of RAID is to use an array of smaller disks to simulate a larger disk (and in some cases provide better performance, reliability, and redundancy).

RAID 0	Data striping
RAID 1	Disk mirroring
RAID 2	Bit-striping with ECC disks
RAID 3	Byte-striping with dedicated parity disk
RAID 4	Block-striping with dedicated parity disk
RAID 5	Block-striping with interleaved parity
RAID 6	Block-striping with two interleaved parity disks for DEC

Which is faster for reading data (in a similar setup): RAID 0 or RAID 5? What about RAID 0 or RAID 1?

Exercise 3 (Memory Mapped I/O): Certain memory addresses correspond to registers in I/O devices rather than physical memory. The control register indicates if the I/O device is ready to transmit/receive data in the data register.

Register	Location	Contains
Receiver Control	0xFFFF0000	Lowest bit is ready bit
Receiver Data	0xFFFF0004	Lowest byte is received data
Transmitter Control	0xFFFF0008	Lowest bit is ready bit
Transmitter Data	0xFFFF000C	Lowest byte is data to transmit

Write MIPS code to read a byte from the receiver as soon as it becomes ready and send it to the transmitter.

Exercise 4 (Polling and Interrupts): Fill in the table below:

Operation	Definition	Pros/Cons	Ideal Use
Polling			
Interrupt-Driven I/O			