

Sample Final Questions

1. Suppose we had a block transfer from an I/O device to memory. The block consists of 1024 words and one word can be transferred at a time. For each of the following, indicate the number of interrupts needed to transfer a block:
 - a) programmed-I/O
 - b) interrupt-driven I/O
 - c) DMA (direct-memory access)
2. What is the main difference between programmed I/O and interrupt-driven I/O?
3. What is the main difference between interrupt-driven I/O and DMA?
4. Assume special I/O instructions are used to fill I/O-interface registers. Why can't a user program use these instructions to communicate with the I/O device directly and "by-pass" the operating system's protection checking?
5. Assume that memory-mapped I/O is used. Since Load and Store instructions are used to communicate with the I/O-interface registers, why can't a user program communicate with the I/O device directly and "by-pass" the operating system's protection checking?
6. Explain how a computer can protect against a user program going into an infinite loop.
7. Draw an output transfer timing diagram using multiple clock cycles for a synchronous bus.
8. What are the goals of the memory hierarchy on a computer system?
9. Consider the following "calculate" function that utilizes two functions: "calculateMore" and "calculateMore2."

```

function (return integer) calculate (integer A, integer B, integer C)
  local integer variables: D and E
  E = calculateMore(A, B)
  D = E + C
  D = calculateMore2(E, D, A)
  return D
end calculate
  
```

a) Using the MIPS register conventions (\$a0-\$a3, \$t0-\$t9, \$s0-\$s7, \$v0-\$v1, \$sp, \$ra), what registers would be used to pass each of the following parameters into "calculate":

A	B	C

b) Using the MIPS register conventions, which of these parameters ("A", "B", "C") should be moved into \$s-registers?

c) Using the MIPS register conventions, what registers should be used for each of the local variables:

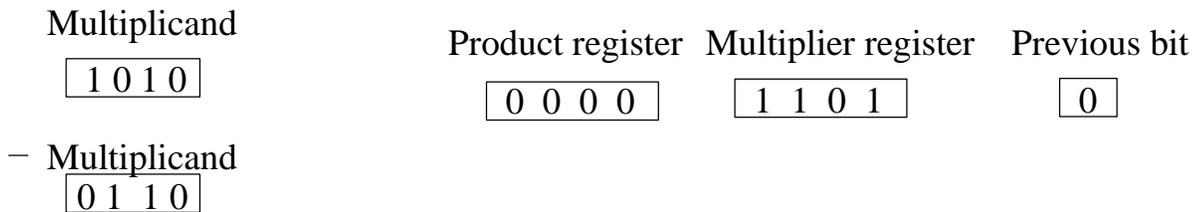
D	E

d) For the registers indicated above, write the assemble language code for the complete function "calculate". (You do not need to write the code for functions calculateMore or calculateMore2, just include the code to call them.)

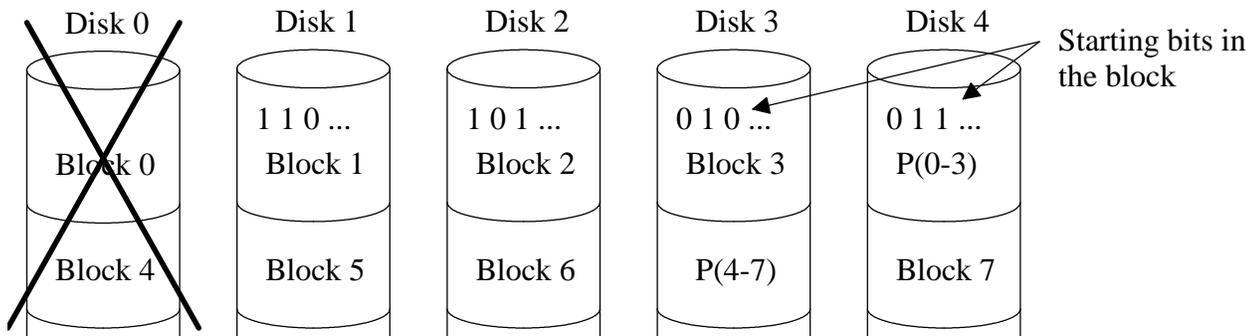
10. When a caller subprogram calls/invokes a callee subprogram, MIPS register conventions use a combination of the caller-save (for \$t0-\$t9) and callee-save (for \$s0-\$s7) register conventions. Explain why a combination is better than just using either caller-save or callee-save register convention.

11. In the last lab, we used bit strings to represent sets of letters stored in a 32-bit word. Suppose we have two bitStrings in \$a0 and \$a1. Write the MIPS assembly language code to check if \$a0 is a subset of \$a1. (Recall that \$a0 is a subset of \$a1 if every element of \$a0 is also in \$a1)

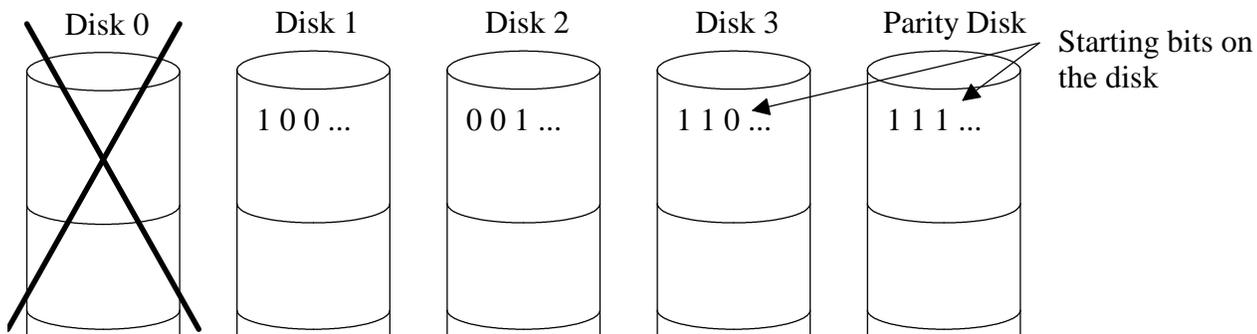
12. Use Booth's algorithm to calculate the 8-bit product of $1010_2 \times 1101_2$.



13. a) Suppose we have a 5 disk RAID 5 (block-level distributed parity) array. If Disk 0 crashes, reconstruct the first three bits of block 0. Assume even parity is being used.



b) Suppose we have a 5 disk RAID 3 (bit-interleaved parity) array. If Disk 0 crashes, reconstruct the first three bits on disk 0. Assume even parity is being used.



c) Suppose we have an 5 disk RAID array with each disk having a 100 MB/sec data transfer rate. Complete the following table **assuming Disk 0 is faulty as in parts (a) and (b)**.

RAID Level	Maximum number of concurrent, independent READs	Maximum number of concurrent, independent WRITEs	Data Transfer Rate for a single large READ
RAID 5 (block-level distributed parity)			
RAID 3 (bit-interleaved parity)			