

Computer Architecture & Organization

1. [20%] What is the difference between RAID 3 (bit-interleaved parity) and RAID 4 (block-interleaved parity). Please compare the number of disk accesses for a small write.
2. [15%] Please explain what is a 2-bit branch prediction and how it works.
3. [15%] Please explain what is a 4-way set-associate cache and how it works.
4. [10%] A somewhat complex C statement contains the five variables f, g, h, l, and j:
$$F=(g+h)-(i+j);$$

What would a C compiler produce?
5. [20%] Multiple forms of addressing are generically called addressing modes, and there are five MIPS addressing modes: (1) Register addressing; (2) Base or displacement addressing; (3) Immediate addressing; (4) PC-relative addressing; (5) Pseudodirect addressing. Please explain them briefly.
6. [20%] There are two possible ways to enhance a computer: (1) make multiply instructions run four times faster than before; (2) make memory access instructions run two times faster than before. An engineer repeatedly runs a program that takes 100 seconds to execute. Of this time, 20% is used for multiplication, 50% for memory access instructions, and 30% for other tasks.
 - (1) What will the speedup be if only multiplication is improved?
 - (2) What will the speedup be if only memory access is improved?
 - (3) What will the speedup be if both improvements are made?