Some of the answers to these questions can be found using the lecture slides, the recommended textbooks or other sources (question marked with *). Some questions may have more than one possible answer, or be more or less open for discussion. Note that no answers (solutions) will be given to these questions, but if help is needed the assistants will be available to answer questions. The concepts marked with yellow are important and should be fully understood.

Multiprocessors

1. UMA Multiprocessors with Bus-Based Architectures - Overview
   (a) Explain how a bus-based architecture works.
   (b) Discuss the architecture from a scalability point of view.
   (c) Describe bus-based architecture varieties that aim at decreasing the amount of memory accesses along the bus.
2. UMA Multiprocessors with Bus-Based Architectures - Performance issues
   (a) If a CPU uses one memory request on every instruction and the computer runs at 200 MIPS, about how many CPUs will it take to saturate a 400-MHz bus? Assume that a memory reference requires one bus cycle.
   (b) Repeat the previous problem for a system that uses caching with a cach hit rate of 90%.
   (c) What cache hit rate would be needed to allow 32 CPUs to share the bus without overloading it?
3. Omega switching network
   (a) How does CPU 011 access memory 000, how CPU 111 memory 100.
   (b) Suppose that the wire between switch 2A and switch 3B in the omega network breaks. Who is cut off from whom?
4. Multiprocessor scheduling
   (a) Explain the differences of time sharing and space sharing scheduling in multiprocessor systems.
   (b) Think of a set of threads in a multithreading and multiprocessor environment, which are related to each other, i.e., groups A_i and B_i of threads that frequently pass messages within their respective group. What are the potential drawbacks and performance ramifications?
   (c) What is gang scheduling and what is the rationale behind that policy?

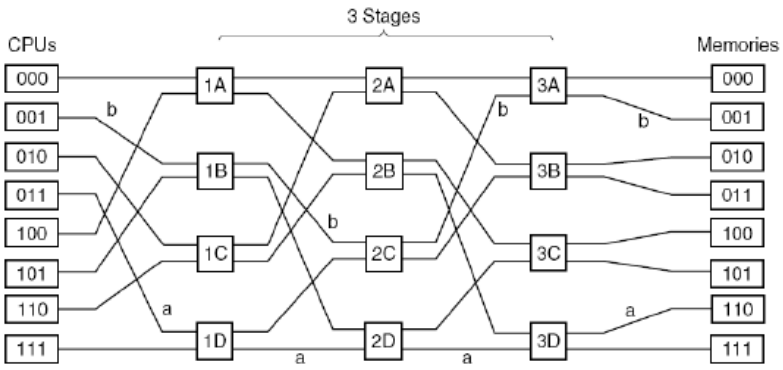

Figure 1: Omega switching network, three stages, CPUs on the left, memories to the right