Architecture Comprehensive Exam

Spring 2014

Student ID # ______________________________

3/18/2014

The questions are on the attached page. Write your answers on the paper provided.

Closed book, closed notes.

Calculators are not to be used.
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1. In reference to I/O systems:
   a) Define the terms response time and throughput.
   b) Assume an I/O system in equilibrium, if the average time to service an I/O request is 40 ms and the I/O system averages 100 requests per second, what is the mean number of I/O requests in the system?

2. The following questions refer to conditions that can occur during pipelining of instruction execution:
   a) Define the term data hazard and describe how these hazards can occur. Give an example of how two or more instructions can create a data hazard (you can use pseudocode or assembly language).
   b) Describe how forwarding can be used to avoid data hazards. Use your example from part a) to explain how forwarding would solve that particular problem.
   c) Explain how branch prediction is used to reduce the occurrence of pipeline hazards. Give an example that illustrates your explanation.

3. The following questions pertain to the memory cache on a single processor system:
   a) Given a system with a cache hit time of 10ns, miss penalty of 100ns and hit rate of 95%, what is the average memory access time?
   b) Explain the difference between a write-through cache policy and a write-back cache policy, including a brief description of the benefits of each.
   c) Describe one advantage and one disadvantage of increasing the block size in a cache.

4. Both of the following questions refer to virtual memory:
   a) Briefly explain the benefits of using virtual memory in a multiuser computer system.
   b) Explain why a translation look-aside buffer (TLB) is used with virtual memory and describe how it improves the average memory access time.