

1. (8 %) Please explain the following terminologies:
 - (a) Setup time and Hold time; (4%)
 - (b) Embedded System; (4%)
2. (15%) The number of registers that are provided in the CPU may affect an instruction length, hardware complexity, software programming and also the program execution performance; please explain why?
3. (15%) Explain the major differences among the general-purpose processor (like Pentium), application-specific (like DSP) and single-purpose processors?
4. (12%) How SPARC window-based register file can be used to improve the performance of procedure call/return function? And what is the key point or main concept of this enhancement? If the number of windows is not enough for your program nested call, describe how SPARC faces this problem, i.e., what actions need to be performed during Call and Return)?
5. (15%) Please answer the following problems about Booth's algorithm
 - (a) Explain how the Booth's algorithm implements the multiplication operation; (5%)
 - (b) Prove that the Booth's algorithm can process the multiplication with one signed number; (10%)
6. (15%) Please answer the following problems
 - (a) Explain the difference between PC-relative addressing and pseudodirect addressing in MIPS instruction set; (5%)
 - (b) Explain how to release the data hazards and the branch hazards in pipelining design; (10%)
7. (20%) Please answer the following problems in cache design
 - (a) Explain why L1 cache is divided into D-cache and I-cache in modern computer design; (5%)
 - (b) Explain why n-way set associative cache is often used in high-performance computer design; (5%)
 - (c) Explain the effect on miss rate and the performance effect for increasing the cache size, the associativity and the block size; (10%)