Assembly Language Final Test **12/27/2023**

Test time: 70 minutes

1. *Cache Memory Hierarchy: (15%)*
   (a) Explain what is the cache memory hierarchy? (5%)
   (b) Explain how cache to improve the software execution performance? (5%)
   (c) Why cache structure does not like the 'go to' or 'jump' instructions? (5%)
2. *Explain why the more number of CPU registers and cache memory space can increase the software execution performance/speed and reduce the power consumption of software running? (10%)*
3. *The runtime stack is a memory array managed directly by the CPU, using the ESP register, known as the stack pointer register. (40%)*
   (a) A stack frame is the area of the stack set which can be used to store four types of data. Please describe what are the four types of data? (8%)
   (b) When you call a procedure using CALL instruction, and return from a procedure using RET instruction, how the CPU handles the CALL and RET instructions, i.e. explain the operations of CALL and RET instructions. What is the difference of the operation between 'RET' and 'RET n' instructions? (14%)
   (c) There are two possible ways to pass the parameters (or arguments) to procedures. Please describe these two approaches and how to implement the approaches using stack memory. (12%)
   (d) Explain the purpose of the EBP base register used in the stack operation. (6%)
4. *Explain why the CPU needs to have the status flags and the purposes of the status flags, like Zero flag and Overflow flag? (10%)*
5. *Multiplication: (25%)*
   (a) Present three techniques to implement the multiplication of two numbers. (9%)
   (b) In binary multiplication, for example 123 × 36, propose a general methodology to implement the binary multiplication using shifting and addition instructions. (16%)

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                01111011      123
          ×     00100100      36
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                01111011      123 SHL 2
        +   01111011          123 SHL 5
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        0001000101001100      4428
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