1. (9 pts) List the three basic control structures for designing a structured program, and use the C language to give an example for each of them.

2. (8 pts) Write down a C program to calculate the sum of $3 + 6 + 9 + \ldots + 99$, and print out the result.

3. (9 pts) $(1C36)_{16} - (3539)_{10} = (????)_{8}$

4. (10 pts) Use the $1$-bit full adder as the building block to design a $1$-digit BCD (Binary Coded Decimal) adder.

5. (14 pts) A CPU contains a 32-Kbyte first-level cache that is addressed by the 32-bit virtual address generated by the CPU. The block size of the cache is 32 bytes and the tag field of the cache controller is $18$ bits. Moreover, the memory is byte-addressable and the cache controller implements the LRU (Least Recently Used) replacement policy. Answer the following two questions:
   a. (4 pts) What is the degree of set associativity of the cache?
   b. (10 pts) After the system is reset, the CPU accesses the memory with the following sequence:
      
      1245C6C4Hx 228046C5Hx 228006D8Hx 228046D9Hx 1245C6C3Hx

      How many cache misses will occur?

6. (10 pts) (a) An algorithm that is $O(n^2)$ takes 10 seconds to execute on a particular computer when $n=50$. How long would you expect it to take when $n=2500$?
   (b) An algorithm that is $O(\log_2 n)$ takes 10 seconds to execute on a particular computer when $n=50$. How long would you expect it to take when $n=2500$?

7. (10 pts) Convert the number $-60_{10}$ into a 8-bit binary number using the two’s complement notation.

8. (15 pt.) Here is an algorithm for calling a friend on the telephone:
   
   Step | Operation
   1.   | Dial the number and wait for either an answer or a busy signal.
   2.   | If the line is not busy, then talk until you are done (hang up the phone).
   3.   | Otherwise (the line is busy), then wait exactly 1 minute and go to step 1.

   This algorithm could lead to the deadlock problem. Explain the problem and suggest how it could be solved.

9. (15 pts) State the major differences between the IP protocol layer and the TCP protocol layer.