Submit solutions through the CVN website. Do this assignment alone. You may consult the instructor and the TAs, but not other students.

1. For the following C array,
   ```c
   int a[2][3];
   ```
   assume you are working with a 32-bit little-endian processor with the usual alignment rules (e.g., a Pentium) and
   (a) Show how its elements are laid out in memory.
   (b) Write the address expression for accessing `a[i][j]`.
   (c) Verify parts a) and b) by writing a small C program that contains and accesses such an array and looking at the assembly language output with the C compiler’s `-S` flag (e.g., `gcc -O -S array.c`). Turn in a copy of your C program and an annotated version of the assembly listing. Make sure the assembly listing is no more than 40 lines.

2. In an assembly-language-like notation (e.g., use MIPS or a pseudocode of your own choosing), write what an optimizing compiler would produce for the following two switch statements.
   ```c
   switch (a) {
     case 5: x = 2; break;
     case 6: x = 5; break;
     case 7: x = 24; y = 11; break;
     case 8: y = 8; break;
     case 9: z = 3; break;
     default: z = 4; break;
   }

   switch (b) {
     case 5: a = 18; break;
     case 73: a = 2; break;
     case 105: b = 7; c = 10; break;
     case 5644: c = 8; break;
     default: c = 17; break;
   }
   ```

3. For a 32-bit little-endian processor with the usual alignment rules, show the memory layout and size in bytes of the following three C variables.
   ```c
   union {
     short a; /* 16-bit */
     struct {
       int b; /* 32-bit */
       char c; /* 8-bit */
     } s;
   } ul;

   struct {
     short a;
     char b;
     short c;
     int d;
   } s1;

   struct {
     int d;
     short a;
     short c;
     char b;
   } s2;
   ```

4. Consider the following C-like program.
   ```c
   int w = 8;
   int x = 12;
   int incw() { return ++w; }
   int incx() { return ++x; }

   void foo(y, z){
     printf("%d\n", y + 1 + y);
     x = 4;
     printf("%d\n", z);
   }

   int main() {
     foo(incw(), incx()); return 0;
   }
   ```
   What does it print if the language uses
   (a) Applicative-order evaluation?
   (b) Normal-order evaluation?