1. For the following C array,

```
int a[3][2];
```

(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.

```
switch (a) {
    case 1: x = 7; break;
    case 2: x = 1; break;
    case 3: x = 8; y = 42; break;
    case 4: y = 17; break;
    case 5: z = 18; break;
    default: z = 3; break;
}

switch (b) {
    case 1: a = 3; break;
    case 10: a = 9; break;
    case 100: b = 14; c = 12; break;
    case 1000: c = 23; break;
    default: c = 20; break;
}
```

What does it print if the language uses
(a) Applicative-order evaluation?
(b) Normal-order evaluation?

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.

```
union {
    int a;
    struct {
        char b; /* 8-bit */
        int c; /* 32-bit */
    } s;
} u1;

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

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

4. Consider the following C-like program.

```
int w = 5;
int x = 6;

int incw() { return ++w; }
int incx() { return ++x; }

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

int main(){
    foo(incw(), incx()); return 0;
}
```

What does it print if the language uses
(a) Applicative-order evaluation?
(b) Normal-order evaluation?