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 a good optimizing compiler would produce for the following two switch statements.

```c
switch (a) {
    case 1: x = 3; break;
    case 2: x = 5; break;
    case 3: x = 8; y = 15; break;
    case 4: y = 20; break;
    case 5: z = 23; break;
    default: z = 28; break;
}
```

```c
switch (b) {
    case 1: a = 3; break;
    case 10: a = 5; break;
    case 100: b = 8; c = 15; break;
    case 1000: c = 20; break;
    default: c = 25; 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 C types.

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

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

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

4. Consider the following C-like program.

```c
int w = 3;
int x = 10;

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

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