Problem 44. (8 points):

You are writing a new 3D game that you hope will earn you fame and fortune. You are currently working on a function to blank the screen buffer before drawing the next frame. The screen you are working with is a 640x480 array of pixels. The machine you are working on has a 64 KB direct mapped cache with 4 byte lines. The C structures you are using are:

```
struct pixel {
    char r;
    char g;
    char b;
    char a;
};

struct pixel buffer[480][640];
register int i, j;
register char *cptr;
register int *iptr;
```

Assume:

- `sizeof(char) = 1`

- `sizeof(int) = 4`

- `buffer` begins at memory address 0

- The cache is initially empty.

- The only memory accesses are to the entries of the array `buffer`. Variables `i`, `j`, `cptr`, and `iptr` are stored in registers.

A. What percentage of the writes in the following code will miss in the cache?

```
for (j=0; j < 640; j++) {
    for (i=0; i < 480; i++){
        buffer[i][j].r = 0;
        buffer[i][j].g = 0;
        buffer[i][j].b = 0;
        buffer[i][j].a = 0;
    }
}
```

Miss rate for writes to buffer: _____ %

B. What percentage of the writes in the following code will miss in the cache?

```
char *cptr;
cptr = (char *) buffer;
for (; cptr < (((char *) buffer) + 640 * 480 * 4); cptr++)
    *cptr = 0;
```

Miss rate for writes to buffer: _____ %

C. What percentage of the writes in the following code will miss in the cache?

```
int *iptr;
iptr = (int *) buffer;
for (; iptr < (buffer + 640 * 480); iptr++)
    *iptr = 0;
```

Miss rate for writes to buffer: _____ %

D. Which code (A, B, or C) should be the fastest? _____