

Problem 46. (7 points):

After watching the presidential election you decide to start a business in developing software for electronic voting. The software will run on a machine with a 1024-byte direct-mapped data cache with 64 byte blocks. You are implementing a prototype of your software that assumes that there are 7 candidates. The C-structures you are using are:

```
struct vote {
    int candidates[7];
    int valid;
};

struct vote vote_array[16][16];
register int i, j, k;
```

You have to decide between two alternative implementations of the routine that initializes the array `vote_array`. You want to choose the one with the better cache performance. You can assume:

- `sizeof(int) = 4`
- `vote_array` begins at memory address 0
- The cache is initially empty.
- The only memory accesses are to the entries of the array `vote_array`. Variables `i`, `j` and `k` are stored in registers.

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

```
for (i=0; i<16; i++){
    for (j=0; j<16; j++) {
        vote_array[i][j].valid=0;
    }
}

for (i=0; i<16; i++){
    for (j=0; j<16; j++) {
        for (k=0; k<7; k++) {
            vote_array[i][j].candidates[k] = 0;
        }
    }
}
```

Total number of misses in the first loop: _____ %

Total number of misses in the second loop: _____ %

Overall miss rate for writes to vote_array: _____ %

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

```
for (i=0; i<16; i++){
    for (j=0; j<16; j++) {
        for (k=0; k<7; k++) {
            vote_array[i][j].candidates[k] = 0;
        }
        vote_array[i][j].valid=0;
    }
}
```

Miss rate for writes to vote_array: _____ %