

Solutions, Final, CSCI 210, Spring 2004

1. $8 \cdot 1024 = 8192$

2. 256×10^{12}

3. `return (number & place) != 0;`

4.

```
5 7
7 7
```

5. The only change is that the IR will change to $61_{(16)}$.

```
for(int i = 0; i < 100; i++) {
6.   System.out.println(10 * n + i);
}
```

This loop has a common subexpression of $10 * n$. We can save time by computing $10n$ once before we enter the loop, and reusing this result each iteration.

```
int ten_times_n = 10 * n;
for(int i = 0; i < 100; i++) {
    System.out.println(ten_times_n + i);
}
```

7. In static linking, the executable file contains the memory address associated with each symbol directly in the image. In dynamic linking, these addresses are unknown until the program is begun, and then the operating system will repair the memory addresses to refer to the symbols' locations.

8. a. A thread could call `output` while the other thread is between the “`last_checked++;`” and “`primes_found++;`” lines of `advance`, in which case it would display a count that is one less than it ought to be.

b. Modify `advance` to add a synchronized block around these two lines.

```
    synchronized(this) {
        last_checked++;
        primes_found++;
    }
```

Also, mark the entire `output` method as synchronized.

```
public synchronized void output() {
```

9. A 2×4 demultiplexer has three inputs, including a data input and two select inputs representing the two bits of a number s . It has four outputs, number $00_{(2)}$ through $11_{(2)}$. The demultiplexer routes its data input to the output whose number is s ; the other outputs' values will be 0.

10. a. the second ($M[2]$) and sixth ($M[7]$) hit the cache.

b.

line	tag	line data			
0	000	M[0]	M[1]	M[2]	M[3]
1	001	M[12]	M[13]	M[14]	M[15]

11. 204 KB. [Each file requires a single block, so that will take $100 \times 2 = 200$ KB. In addition, the directory will itself require two blocks, since $100 \times 32 = 3200$ is more than one block can hold, for a total of 2×2 kilobytes.]