

Answer **ANY TWO** of the following three questions:

1. (Architecture) Draw a simplified circuit for the Boolean function  $F$  using only NOR and NOT gates:

$$F(a, b, c, d) = (0, 1, 2, 4, 5, 6, 8, 9, 12, 13, 14)$$

- 2.

```
22     consume!";  
23     *  
24     *
```

For each of the following pairs of program line numbers, what would be the potential effects (if any) of swapping the two lines of the program?

- a. 8 and 9
- b. 20 and 21