

Name: _____

Answer all questions in the space provided. Write clearly and legibly, you will not get credit for illegible or incomprehensible answers. Print your name at the top of every page.

This is a closed book exam. However, each student is allowed to bring one page of notes to the exam. Please turn these in with your exam. Also, you are permitted the use of a “dumb” calculator to perform basic arithmetic.

Question:	1	2	3	4	5	6	7	8	Total
Points:	10	18	12	12	6	6	10	15	89
Score:									

1. I have declared two **unsigned char** variables, **a** and **b**. Assume that **a** has been initialized.

(a) I would like to replace the least significant four bits with ones.

(5)

Write a *single line* statement of C code that will accomplish this.

(b) I would like to assign a value to **b** such that **b** is 8 bits long. The least significant two bits of **a** are the most significant three bits of **b**. The remaining bits are zeros.

(5)

Write a *single line* statement of C code that will accomplish this.

2. Select *all* that apply.

- (a) Which of the following are keywords in the C programming language? (6)
- | | | | |
|----------|---------|-------------|-----------|
| A. byte | D. size | G. else | J. do |
| B. elif | E. if | H. signed | K. until |
| C. endif | F. then | I. unsigned | L. unless |

- (b) What are the file permission for foo.c after executing `chmod 725 foo.c`? (4)

- (c) Select the single *best* answer. Assume `x` is already declared and initialized and consider the following code snippet. (3)

```

1 | if ( x = 0 )
2 |     printf ( "x is zero\n" );

```

- A. This code will not compile because of the use of the assignment operator in the if test.
- B. This code will not compile because `printf` is only given one argument.
- C. This code will not compile for some other reason.
- D. This code will compile. It prints “x is zero” when it is run. `x` will be set to zero.
- E. This code will compile. It prints “x is zero” when it is run. `x` will remain its original value.
- F. This code will compile, but nothing will be printed when it is run. `x` will be set to zero.
- G. This code will compile, but nothing will be printed when it is run. `x` will remain its original value.
- H. This code will compile, but it will crash when run.

- (d) What is the value of `x` after the following code is run? (3)

```

1 | int x = 0;
2 | for (x=5; x>5; ++x)
3 |     {
4 |         printf("%d", x);
5 |     }

```

- A. 0 B. 1 C. 3 D. 4 E. 5 F. 6 G. 9 H. 10 I. undefined

- (e) Which of the following gives the value stored at the address pointed to by a pointer `p`? (2)
- A. `p` B. `sizeof(p)` C. `*p` D. `&p` E. `~p` F. `p.value` G. `p->value`

3. The following program compiles and runs. What is its output?

(12)

```
1 #include <stdio.h>
2
3 int n = 10;
4
5 int foo(int x)
6 {
7     int y = n;
8     y++;
9     x = x+n;
10    printf("foo: x = %d, y = %d, n = %d\n", x, y, n);
11    return x;
12 }
13
14 int main()
15 {
16     int x, n;
17     x = 4;
18     n = foo(x);
19     printf("main: n = %d, x = %d\n", n, x);
20     x = foo(n);
21     printf("main: n = %d, x = %d\n", n, x);
22
23     return 0;
24 }
```

4. The following program compiles and runs. What is its output?

(12)

```
1 #include <stdio.h>
2
3 int main()
4 {
5     unsigned char x = 176;
6     unsigned char y = 129;
7     unsigned char z = 125;
8
9     unsigned char a = x << 2;
10    unsigned char b = x >> 3;
11    unsigned char c = x & y;
12    unsigned char d = x & z;
13    unsigned char e = x | y;
14    unsigned char f = x ^ z;
15
16    printf("a = %d\n", a);
17    printf("b = %d\n", b);
18    printf("c = %d\n", c);
19    printf("d = %d\n", d);
20    printf("e = %d\n", e);
21    printf("f = %d\n", f);
22
23    return 0;
24 }
```

5. The following program compiles and runs. What is its output?

(6)

```
1 #include <stdio.h>
2
3 int main()
4 {
5     char data[] = "PUPPYDOGS";
6     char *linePt = &data[2];
7     *linePt = 'G';
8     linePt++;
9     linePt[5] = '!';
10    linePt++;
11    data[3] = '\\0';
12    printf("%s, %s\\n", data, linePt);
13
14    return 0;
15 }
```

6. The following program compiles and runs. What is its output?

(6)

```
1 #include <stdio.h>
2
3 struct Point
4 {
5     int x;
6     int y;
7 };
8
9 struct Point foo(struct Point* p1, struct Point p2)
10 {
11     (*p1).x--;
12     p1->y -= p2.x;
13     p2.x++;
14     p2.y += p1->x;
15     return p2;
16 }
17
18 int main()
19 {
20     struct Point a = {1, 0};
21     struct Point b = {3, 2};
22     struct Point c = foo(&a, b);
23
24     printf("a=(%d, %d)\n", a.x, a.y);
25     printf("b=(%d, %d)\n", b.x, b.y);
26     printf("c=(%d, %d)\n", c.x, c.y);
27
28     return 0;
29 }
```

7. The following program is meant to fill an array with Fibonacci numbers and then print them out. Unfortunately, the programmer made a two small mistakes that prevent the program from running properly.

```
1 #include <stdio.h>
2
3 int fib(int x)
4 {
5     if (x==0)
6     {
7         printf("0\n");
8         return 0;
9     }
10    else
11    {
12        int y = fib(x-1) + fib(x-2);
13        printf("%d\n", y);
14        return y;
15    }
16 }
17
18 int main(void)
19 {
20     fib(4);
21     return 0;
22 }
```

- (a) There is a mistake that prevents the program from running without crashing. (5)
- Which line needs to be changed to allow the program to run correctly?
 - How do you change the problem line to fix the program?
- (b) Assuming the above code is correct, how many numbers will be printed out when this code executes? (5)

8. Diagram the execution of the statement found in the main method. (You do not need to use a frame for the main method.) What is the final value of `a`? (15)

```
1 #include <stdio.h>
2
3 int foo(int x)
4 {
5     if (x>8)
6     {
7         printf("%d\n", x);
8         return x;
9     }
10    else
11    {
12        return 1+foo(x*2);
13    }
14 }
15
16 int main(void)
17 {
18     int a = foo(1);
19     printf("%d\n",a);
20 }
```