Name:_____   NetID:_____

Answer all questions in the space provided. Write clearly and legibly, you will not get credit for illegible or incomprehensible answers. This is a closed book exam. However, each student is allowed to bring one page of notes to the exam. Print your name at the top of every page.

Question:	1	2	3	4	5	6	7	8	9	10	Total
Points:	10	18	12	12	6	6	4	4	4	4	80
Score:											

Multiple Choice

1. For these questions, select all that apply.

    (a) Which of the following are *not* keywords in the C programming language?   (5)
    - A. boolean
    - B. case
    - C. continue
    - D. do
    - E. if
    - F. int
    - G. then
    - H. type
    - I. typedef
    - J. union

    (b) Which of the following are true?   (5)
    - A. `0`
    - B. `'0'`
    - C. `'\0'`
    - D. `1`
    - E. `-1`
    - F. `sizeof(char)-1`
    - G. `4 >> 3`
    - H. `0.25`
    - I. `1/4`
    - J. `1.0/4.0`

2. For these questions, select the single best answer.

 (a) How many times is a do while loop guaranteed to loop?   (3)

    A. 0

    B. 1

    C. Infinitely

    D. Variable

 (b) What is the final value of x when the following code is run?   (3)

```
1 int x;
2 for(x=0; x<10; x++) { }
```

    A. 10

    B. 9

    C. 0

    D. 1

    E. undefined

 (c) What is the return type of the function with the following prototype?   (3)

```
1 int foo(char x, float v, double t);
```

    A. char

    B. double

    C. float

    D. foo

    E. int

 (d) Which of the following is a proper declaration of a pointer?   (3)

    A. `int x;`

    B. `int &x;`

    C. `ptr x;`

    D. `int *x;`

 (e) Which of the following gives the memory address of integer variable `a`? (3)

    A. `*a`

    B. `a`

    C. `&a`

    D. `address(a)`

 (f) Which of the following gives the value stored at the address pointed to by pointer `a`? (3)

    A. `a`

    B. `val(a)`

    C. `*a`

    D. `&a`

Code Output

3. The following program compiles and runs. What is its output?   (12)

```c
#include <stdio.h>

int x=7;

int foo(int n)
{
  int y=5;
  x += 3;
  y -= 2;
  n += x-y;
  printf("foo: x=%d, y=%d, n=%d\n", x, y, n);
  return n;
}

void main(void)
{
  int x, n;
  n = 4;
  x = foo(n);
  printf("main: n=%d, x=%d\n", n, x);

  x = foo(n);
  printf("main: n=%d, x=%d\n", n, x);
}
```

4. The following program compiles and runs. What is its output?   (12)

```
1  #include <stdio.h>
2
3  void main(void)
4  {
5    unsigned char x = 37;
6    unsigned char y = 62;
7    unsigned char z = 235;
8
9    unsigned char a = x << 3;
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 ^ y;
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 }
```

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

```c
#include <stdio.h>

void main(void)
{
  char data[] = "testingTest";
  char *linePt = &data[7];
  data[2] = 'x';
  *linePt = 'P';
  printf("[%s], [%s]\n", data, linePt);
}
```

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

```c
#include <stdio.h>

struct Point
{
  int x;
  int y;
};

struct Point foo(struct Point p1, struct Point *p2)
{
  p1.x /= p2->y;
  p2->x *= p1.y;
  p1.y++;
  p2->y--;
  return p1;
}

void main(void)
{
  struct Point a = {9, 4};
  struct Point b = {2, 3};
  struct Point c = foo(a, &b);

  printf("a=(%d, %d)\n", a.x, a.y);
  printf("b=(%d, %d)\n", b.x, b.y);
  printf("c=(%d, %d)\n", c.x, c.y);
}
```

Recognizing bad code

The following programs either fail to compile, or if they do compile, fail to run correctly. For each of these problematic programs, answer the following:

- What will go wrong with this program? (I'm not expecting you to know exact error messages, but at the very least recognize if the program will fail to compile, possibly crash with a segmentation fault, run into an infinite loop, etc.)
- Which line(s) needs to be changed to allow the program to run as intended?
- How do you change the problem line to fix the program?

7. A simple program to demonstrate a function call.   (4)

```
1   #include<stdio.h>
2
3   int foo(float x);
4
5   void main(void)
6   {
7       int n=5;
8       printf("%d\n", foo(n));
9   }
10
11  int foo(int n)
12  {
13      return 2*n;
14  }
```

8. Use recursion to print out the binary representation of a number. (4)

```c
#include <stdio.h>

void printBinary(unsigned int n)
{
  if (n / 2)
  {
    printBinary(n);
  }
  printf("%d", n % 2);
}

void main(void)
{
  printBinary(31);
}
```

9. Fill an array with Fibonacci numbers and print them out.   (4)

```c
#include <stdio.h>

#define ARRAYSIZE = 10

void main(void)
{
  int i;
  int n[ARRAYSIZE];
  n[0] = 1;
  n[1] = 1;
  for (i=2; i<ARRAYSIZE; i++)
  {
    n[i] = n[i-2] + n[i-1];
  }
  for (i=0; i<ARRAYSIZE; i++)
  {
    printf("%d ", n[i]);
  }
  printf("\n");
}
```

10. Print out the factors of a number.   (4)

```
1  #include <stdio.h>
2
3  void printFactors(int n);
4
5  int main()
6  {
7    printFactors(36);
8    return 0;
9  }
10
11  void printFactors(int n)
12  {
13    int i = 2;
14    while(i < n);
15    {
16      if(n % i == 0) printf("%d ", i);
17      ++i;
18    }
19    printf("\n");
20  }
```