

Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page.

Name: _____

Date: _____

Question:	1	2	3	4	5	6	7	8	9	Total
Points:	10	10	10	15	5	5	5	10	10	80
Score:										

1. What is going to be printed by the fragment of the code below?

(a) (5 points)

(b) (5 points) Modify the initial value of variable 'i' such that the very last number printed is '11'.

```
int i = 41;
while ( i <= 41) {
    printf("%d %o %x\n", i, i, i++);
}
```

2. (a) (5 points) Evaluate 'A' $\oplus$ 'y'. (Use the ascii table on page 4.) Present the result as a binary number.

(b) (5 points) What are the decimal, the octal, and the hexadecimal values of the result?

3. As a part of the solution of a particular problem you need calculations with full machine precision of the following expression:

$$\frac{\sin(x)}{\cos(x) - \sqrt{1 - \sin(x)}}, \quad (1)$$

where x is such that $0 < x \ll \epsilon$; here ϵ is machine epsilon.

(a) (5 points) Briefly describe what troubles you expect when using Eq. (1)?

(b) (5 points) Rewrite Eq. (1) to avoid those troubles.

Local and global variables

4. Describe exactly but briefly what is the output of the program.

```
#include <stdio.h>

#define N 6

int g = 1.;

double fun(double x, double y[]) {
    y[4] *= g;
    printf("fun:      %f %f %d\n", x, y[4], g);
    return((y[1] + y[4])*x);
}

int main(void) {
    double x = 2., y[N];
    int i;

    g += 1;
    for(i = 0; i < N; i++) {
        y[i] = g*i;
    }

    printf("main 1: %f %f %d\n", x, y[4], g);
    x = fun(x, y);
    printf("main 2: %f %f %d\n", x, y[4], g);

    return(0);
}
```

- (a) (5 points) The first printf statement in the main program:

- (b) (5 points) The printf statement in the function fun:

- (c) (5 points) The second printf statement in the main program:

Multiple choice questions.

For each of the following questions or statements, circle the number (0, 1, 2, or 3) of the one response that best answers the question or completes the statement.

5. (5 points) How many distinct values can be represented by a sequence of 4 bits?

- 0 4
- 1 8
- 2 16
- 3 32

6. (5 points) What is/(are) the default value(s) of uninitialized variables in C?

- 0 01010101₂
- 1 0
- 2 there is no default value for uninitialized variables. The actual value may depend open the compiler, compiler options, operating systems, etc.
- 3 0 for integers, -0.0 for floating point numbers, "a" for character strings

7. (5 points) Which of the following code fragments below produce identical output.

- 1.

```
int x = 0, i;
for (i = 0; i < 1; i++)
    printf("%d", x);
```
- 2.

```
int x = 0, i = 0;
while (i < 1) {
    printf("%d", x);
    i += 1;
}
```
- 3.

```
int x = 0;
printf("%d", x++);
```
- 4.

```
int x = 0;
while (x < 1)
    printf("%d", ++x);
```

- 0 only 1 and 2
- 1 only 3 and 4
- 2 only 1, 2, and 3
- 3 all code fragments produce identical output

8. (10 points) Consider the code below.

```
int i, j;
for (i = 0; i < 5; i++)
    for (j = i; j < 5; j++)
        printf("*");
```

How many asterisks does this code print in total?

- 0 5
- 1 10
- 2 15
- 3 25

One-time pad

9. (a) (5 points) Convert the numbers of your answers for Questions 5–8 to two-bit binary strings and concatenate four strings together.

The resulting binary string represents your one-byte plaintext message.

- (b) (5 points) Encrypt the message using the following one-time pad: ____ . (You may need the ascii table on page 4.)
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Appendix: ASCII Character Table

Letter	Octal code	Binary code	Letter	Octal code	Binary code
a	097	01100001	A	065	01000001
b	098	01100010	B	066	01000010
c	099	01100011	C	067	01000011
d	100	01100100	D	068	01000100
e	101	01100101	E	069	01000101
f	102	01100110	F	070	01000110
g	103	01100111	G	071	01000111
h	104	01101000	H	072	01001000
i	105	01101001	I	073	01001001
j	106	01101010	J	074	01001010
k	107	01101011	K	075	01001011
l	108	01101100	L	076	01001100
m	109	01101101	M	077	01001101
n	110	01101110	N	078	01001110
o	111	01101111	O	079	01001111
p	112	01110000	P	080	01010000
q	113	01110001	Q	081	01010001
r	114	01110010	R	082	01010010
s	115	01110011	S	083	01010011
t	116	01110100	T	084	01010100
u	117	01110101	U	085	01010101
v	118	01110110	V	086	01010110
w	119	01110111	W	087	01010111
x	120	01111000	X	088	01011000
y	121	01111001	Y	089	01011001
z	122	01111010	Z	090	01011010