MIDDLE EAST TECHNICAL UNIVERSITY
Department of Computer Engineering

CEng 230: C Language
2005 Fall **Final Exam** **75 min.**

Surname	Name	Student ID	Grading
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Part I: Multiple-Choice (45 pts.)
Three wrong answers will cancel one correct answer! (5 pts. each)

1. For what exact range of values of variable x does the following code segment display the letter 'C'?

```
if (x <= 200)
      if (x < 100)
            if (x <= 0)
                  printf("A\n");
            else
                  printf("B\n");
      else
            printf("C\n");
else
      printf("D\n");
```

a. 0 < x < 100 b. x <= 0
c. 100 <= x <= 200 d. x > 200
e. 100 < x <= 200

Questions 2-3 concern the following program fragment:

```
char r, x, y, z, w;
scanf("%c%c%c%c", &x, &y, &z, &w);
if (x < y)
      r = x;
else
      r = y;
if (r > z)
      r = z;
if (r > w)
      r = w;
printf("%c\n", r);
```

2. What is the program output if the user types *runt* followed by a carriage return (enter) when the program is run?
a. r b. u
c. n d. t
e. none of the above

3. The program's effect can best be described as _____.

a. It displays the letter 'r' after comparing it to x, y, and z.
b. Of the four input characters, it displays the one that comes first in the alphabet.
c. Of the four input characters, it displays the one that comes last in the alphabet.
d. Of the four input characters, it displays the one that comes second in the alphabet.
e. It displays nothing since characters cannot be compared.

Questions 4-5 refer to the following program segment. Assume that all variables are of type int.

```
z = 0;
g = 0;
s = 0;
i = 0;
while (i < 50) {
      scanf("%d", &t);
      s = s + t;
      if (t >= 0)
            g = g + 1;
      else
            z = z + 1;
      i = i + 1;
}
```

4. How many times is the loop body of the while statement executed?

a. once
b. never
c. 49 times
d. 50 times
e. until a number 50 or larger is entered

5. The value stored in variable s at the end of the execution of the loop could best be described as _____.

a. the average of the numbers scanned
b. the sum of the numbers scanned
c. the largest of the numbers scanned
d. how many numbers were scanned
e. nothing meaningful

6. How many lines of output will be displayed by the following program fragment?

```
i = 0
do {
   for  (j = 0;  j < 4;  j = j + 1)
      printf("%d\n", i + j);
   i = i + 1;
} while (i < 5);
```

a. 0
b. 7
c. 9
d. 16
e. 20

For Questions 7-11 assume the following environment.

```
#define MAX 50
int a[MAX], i, j, temp;
```

7. What is the effect of this program segment?

```
for  (i = 0;  i < MAX / 2;  ++i) {
    temp = a[i];
    a[i] = a[MAX - i - 1];
    a[MAX - i - 1] = temp;
}
```

a. Arranges the elements of array a in ascending order.
b. Counts the number of elements of a greater than its first element.
c. Reverses the numbers stored in the array.
d. Puts the largest value in the last array position.
e. None of the above.

8. What is the effect of the following program segment?

```
for  (i = 0;  i < MAX - 1;  ++i)
    if (a[i] > a[i + 1]) {
         temp = a[i];
         a[i] = a[i + 1];
         a[i + 1] = temp;
    }
```

a. Arranges the elements of array a in ascending order.
b. Counts the number of elements of a greater than its first element.
c. Reverses the numbers stored in the array.
d. Puts the largest value in the last array position.
e. None of the above.

9. What is the effect of the following program segment?

```
temp = 0;
for  (i = 1;  i < MAX;  ++i)
    if (a[i] > a[0])
         ++temp;
```

a. Arranges the elements of array a in ascending order.
b. Counts the number of elements of array a greater than its initial element.
c. Reverses the numbers stored in the array.
d. Puts the largest value in the last array position.
e. None of the above.

10. What is the maximum valid subscript value for array a?

a. 0
b. 49
c. 50
d. a[50]
e. none of the above

11. What is the minimum valid subscript value for array a?

a. 0
b. 1
c. any negative number
d. There is no minimum.
e. none of the above

12. Which one of the conditions that follow will be false (value of 0) after execution of the program segment below?

```
int v[5] = {0, 0, 0, 0, 1};
int k, j;
for  (j = 3;  j >= 0;  --j)
    for  (k = j;  k < 4; ++k)
        v[k] += v[k + 1];
```

a. v[0] == v[4]
b. v[1] == v[3]
c. v[0] < v[1]
d. v[1] < v[2]
e. v[2] < v[3]

13. What is the value of variable s after execution of the program fragment below?

```
char h[6] = "wild";
char p[6] = "crazy";
char s[10];

strcpy(s, h);
strcat(s, p);
```

a. "wild crazy"
b. "wild craz"
c. "wildcrazy"
d. The value of s is undefined.
e. none of the above.

14. What does the following C function do?

```
int
fun(const char *string)
{
      char blank = ' ';
      int k;
      int looking = 1;

      k = strlen(string);
      while  (k >= 0 && looking) {
          if (string[k] == blank)
              --k;
          else
              looking = 0;
      }

      if (looking)
          return (-1);
      else
          return (k);
}
```

a. It finds the subscript of the first nonblank character in string.
b. It finds the subscript of the last nonblank character in string.
c. It counts the nonblank characters in string.
d. It finds the subscript of the first blank in string.
e. It finds the subscript of the last blank in string.

15. What will be displayed by the statements below?

```
char s1[8] = "petunia", s2[9] = "marigold";
char tmp1[10], tmp2[20];
strcpy(tmp2, s1);
strcat(tmp2, s2);
strncpy(tmp1, &tmp2[5], 6);
tmp1[6] = '\0';
printf("b%s\n", tmp1);
```

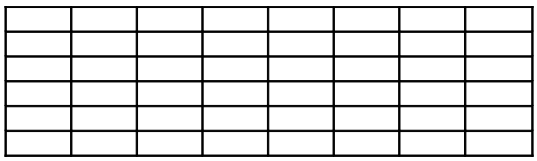
a. iamari
b. biamari
c. oldpet
d. boldpet
e. none of the above

Part II: Tracing (20 pts.)

16. (10 pts) What is the output of the following program?

```
#include <stdio.h>
void p(int x[4],int y[4]) {
  int i;
  for(i=0;i<4;i++)
    if(i%2==0) {
      y[i]=x[i];
      x[i]=x[3-i];
    }
    else
      y[i]=x[3-i];
}
int f(int *a,int b) {
  b=*a+1;
  *a=b/2;
  return *a+b;
}
int main(void) {
  int a[]={5,6,7,8},b[4],x=3,y=8,z=4,i;
  p(a,b);
  for(i=0;i<4;i++) printf("%d,%d\n",a[i],b[i]);
  z=f(&x,y);
  printf("%d,%d,%d\n",x,y,z);
  return 0;
}
```

Answer (assume that the below grid is a screen; use one box per character output):



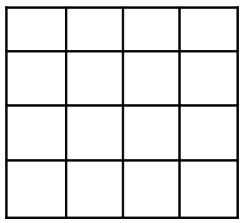
17. (10 pts) What is the content of array **a** after the following program segment is executed?

```
int a[4][4] = {0};
int i,j;

a[0][0] = 1;
for (i=1; i<4;i++)
   for(j=0; j <= i; j++){
      if (j == 0)
     a[i][j] = a[i-1][0];
         else
            a[i][j] = a[i-1][j-1] + a[i-1][j]
```

Answer(assume that each cell shows the content of an array location).

Array a:



Part III: Programming (35 pts.)

18. (10 pts) Write a function
int maxOf(int a[],int n)
which returns the maximum of the first *n* elements of array *a* .

Answer:

19. (10 pts) Write a function
int divAll(int a[],int n,int x)
which returns *true* value if *x* is a common proper divisor of the first *n* elements of array *a* ; *false* otherwise.
Note that

- *x* is a proper divisor of *y* if *x* divides *y*, and $x \neq 1$, and $x \neq y$;
- *x* is a common divisor of y_1 and y_2 if *x* divides both y_1 and y_2 .

Answer:

20. (15 pts) Write a *main* function which
    - reads an integer *n* (≤100);
    - reads *n* integers into an integer array *a* ;
    - finds the summation of the common proper divisors of the first *n* elements of *a* (you should call the functions- maxOf and divAll- defined above for the calculation);
    - prints this summation.

Sample run:

Input:
```
3
2 4 6
```
Output:
```
0     (no common proper divisor!)
```

Sample run:

Input:
```
4
12 30 18 24
```
Output:
```
11      (2+3+6)
```

Answer: