University of Maryland College Park
Dept of Computer Science
CMSC106 Fall 2012
Midterm IIKey

Last Name (PRINT): _______________________________________________________
First Name (PRINT): _____________________________________________________
University Directory ID (e.g., umcpturtle)____________________________________

I pledge on my honor that I have not given or received any unauthorized assistance on this examination.
Your signature: ___________________________________________________________________

Instructions

- Make sure you write your name now (we will not wait for you at the end).
- This exam is a closed-book and closed-notes exam.
- Total point value is 200 points.
- The exam is a 50 minutes exam.
- Please use a pencil to complete the exam.
- WRITE NEATLY.
- You don’t need to use meaningful variable names; however, we expect good indentation.

Grader Use Only

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Total (200)
Problem #1 (20 pts)

1. (4 pts) Draw the memory organization map discussed in lecture. Hint: it has two main components.

   Answer:

   ![Memory Organization Map](image)

   **Grading:**
   
The drawing must have a stack (left) and heap section (right) (2 pts each)

2. (16 pts) To the right of the code, draw a memory map that shows the values that variables have when execution reaches the point indicated by /* HERE */.

   ```c
   #include <stdio.h>
   void f(int a, int b, int *c) {
       int *m = &b;
       a += 3;
       b -= 7;
       *m += 2;
       printf("%d %d %d\n", a, b, *m);
       *c += 1000;
       c = NULL;
       /* HERE */
   }
   int main() {
       int x = 5, y = 20, d = 70;
       int *p = &d;
       f(x, y, p);
       printf("%d %d %d\n", x, y, *p);
       return 0;
   }
   ```
Problem #2 (15 pts)

Implement a function call `random_value` that returns a random value between `lower_limit`(inclusive) and `upper_limit`(inclusive). Remember you can get random numbers using the function `rand()`.

Answer:

```
int random_value(int lower_limit, int upper_limit) {
    int range_size = (upper_limit - lower_limit) + 1;
    int value = (rand() % range_size) + lower_limit;
    return value;
}
```

Problem #3 (15 pts)

Implement a function call `find_type` that returns 1 if the parameter is an uppercase character; 2, if it is a lowercase character; and 3 for any other kind of character. Remember that uppercase characters are in the range 65 to 90, and lowercase characters are in the range 97 to 122. **You may NOT use functions islower nor isupper to implement this function.**

Answer:

```
int find_type(char ch) {
    if (ch >= 65 && ch <= 90)
        return 1;
    else if (ch >= 97 && ch <= 122)
        return 2;
    else
        return 3;
}
```

Problem #4 (25 pts)

Implement a function called `draw_rectangle` that generates a rectangle with the specified width and height and using the character `ch`. For example, calling `draw_rectangle(4, 9, '*')` will generate:

```
*********
*********
*********
*********
```

Remember, your function must work for any dimensions and for any character.

Answer:

```
void draw_rectangle(int width, int length, char ch) {
    int row, col;
    for (row = 0; row < width; row++) {
        for (col = 0; col < length; col++) {
            printf("%c", ch);
        }
        printf("\n");
    }
}
```
Problem #5 (25 pts)

Implement a function called `sum_and_product` that computes the sum and product of values between 1 and the `limit` value provided. The sum and product will be returned using the pointer parameters. For example:

```c
int limit = 4, sum, prod;
sum_and_product(&sum, &prod, limit);
printf("sum: %d, prod: %d\n", sum, prod);
```

will generate the output:

```
sum: 10, prod: 24
```

Answer:

```c
void sum_and_product(int *sum, int *prod, int limit) {
    int i;
    *sum = 0;
    *prod = 1;
    for (i = 1; i <= limit; i++) {
        *sum += i;
        *prod *= i;
    }
}
```