

Nome: \_\_\_\_\_

Versione: A

**Esame di Fondamenti di Informatica**  
**12 marzo 2009**

**Section 1. Multiple choice questions (4 points each)**

- a correct answer is worth 4 points,
- A wrong answer gives a penalty of -1 point,
- No answer gives nopoint.

1. Consider the following function:

```
void fs(char *s)
{
    char *z = s+1;
    if (*s == 0) return;
    while (*z != 0) {
        *s = *z;
        s++; z++;
    }
}
```

Now, suppose we call the function as follows:

```
char s1[] = "abcdef";
...
fs(s1);
```

What is the value of s1 after the call?

- (a) "abcdef"
- (b) "badcfe"
- (c) "fedcba"
- (d) "bcdeff"

2. Find all the values of variable  $a$  such that the following algorithm goes into an infinite loop.

```
int k = 7;
int c = 0;
int a = ??;
while (k % 2)
{
    c = 3*a + k;
    k = 3*c;
}
```

- (a) for  $a \leq 1$
  - (b) for  $a > 1$
  - (c) for all even values of  $a$
  - (d) for all odd values of  $a$
- 

3. Consider the `malloc()` function. Which one of the following sentences is correct?

- (a) The `malloc()` returns the amount of memory allocated
  - (b) The `malloc()` allocates the desired amount of memory on the stack
  - (c) The `malloc()` allocates the desired amount of memory on the heap
  - (d) The allocated memory is only local to the function
-

4. What is printed by the following program:

```
int ii = 5;

int fun(int i)
{
    int ii = 2*i;
    i = i % 10;
    return 2*i;
}

void main()
{
    int x;
    x = fun(ii);
    printf("x = %d    ii=%d\n", x, ii);
}
```

- (a)  $x = 0$  and  $ii = 10$
  - (b)  $x = 10$  and  $ii = 10$
  - (c)  $x = 0$  and  $ii = 5$
  - (d)  $x = 10$  and  $ii = 5$
-

5. Consider the following function:

```
int fc(char *s)
{
    int n = strlen(s);
    int i;
    for (i=0; i<n/2; i++) {
        if (s[i] != s[n - n/2 + i]) return 0;
    }
    return 1;
}
```

Now suppose that the function is called with the following parameters:

```
x1 = fc("abab");
x2 = fc("abba");
x3 = fc("abcba");
x4 = fc("abcab");
```

Which is the value of x1, x2, x3, x4 after the calls?

- (a)  $x1 = 1, x2 = 0, x3 = 0, x4 = 1$
  - (b)  $x1 = 1, x2 = 1, x3 = 1, x4 = 1$
  - (c)  $x1 = 0, x2 = 1, x3 = 1, x4 = 0$
  - (d) none of the above
- 

6. Consider the following code:

```
#define SIZE 2*3
...
int x = 12 / SIX;
int y = SIX / 2;
```

What is the value of x and y after the operations?

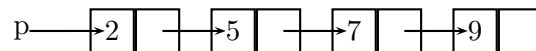
- (a)  $x = 18$  and  $y = 3$
  - (b)  $x = 2$  and  $y = 2$
  - (c)  $x = 18$  and  $y = 2$
  - (d) none of the above
-

7. Consider a linked list, implemented by the following data structure:

```
struct lnode {
    int data;
    struct lnode *next;
};
typedef struct lnode * LIST;

void pf(LIST p)
{
    if (p == 0) return;
    else {
        pf(p->next);
        printf("%d ", p->data);
    }
}
```

Now suppose the list has the following data inside:



What is the output on screen of calling pf() on the above list?

- (a) 2 5 7 9
  - (b) 9
  - (c) 9 7 5 2
  - (d) out of memory
- 

## Section 2. Free questions (6 points)

You are required to write a program or a small text. These questions are valid a maximum of 6 points each.

8. Write a function that takes a string, and reorders all the letters in alphabetic order. The function prototype must be the following:

```
void sortchars(char *str);
```

You can assume that the following functions are defined:

```
void swapchars(char *a, char *b);  
int strlen(char *s);
```

(Hint: use any of the sorting algorithm seen during the lectures)

---

9. Consider the following function.

```
int revert(char *str)  
{  
    int i;  
    int l = strlen(str);  
    char *copied;  
  
    copied = malloc(l+1);  
    strcpy(copied, str);  
  
    for (i = 0; i<l; i++)  
        copied[i] = str[l-i-1];  
  
    copied[l] = 0;  
  
    strcpy(str, copied);  
    return l;  
}
```

The function contains a bug. Can you find it?

---

10. Consider the following C function.

```
int isprime(int a)
{
    int i;
    while (i<a) {
        if (a % i == 0) return 0;
        i++;
    }
}
```

The expected result of `isprime(7)` is 1. However, the function contains a bug. Can you find it?

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# Answer Key for Exam A

## Section 1. Multiple choice questions (4 points each)

1. (d)
2. (c)
3. (c)
4. (d)
5. (a)
6. (a)
7. (c)

## Section 2. Free questions (6 points)

8. **Answer:** A possible implementation is the following:

```
void sortchars(char *str)
{
    int i=0, j=1;
    int l = strlen(str);
    for (i=0; i<l; i++) {
        for (j=i+1; j<l; j++)
            if (str[i] > str[j]) swapchars(&str[i], &str[j])
    }
}
```

9. **Answer:** The function has a “memory leak”: there is a `malloc()`, but not the corresponding `free()`. Therefore, every time it is called, it will continue to allocate memory without releasing it. If the function is called many times, eventually it will cause a “out of memory” error.
10. **Answer:** Variable `i` is not initialized. It can also be negative or very large. If it is 0, the result of the mod operation is undefined.



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Section 1. Multiple choice questions (4 points each)

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- No answer gives nopoint.

1. Consider the following code:

```
#define SIZE 2*3
...
int x = 12 / SIX;
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```

What is the value of x and y after the operations?

- (a)  $x = 18$  and  $y = 3$
  - (b)  $x = 2$  and  $y = 2$
  - (c)  $x = 18$  and  $y = 2$
  - (d) none of the above
-

2. Find all the values of variable  $a$  such that the following algorithm goes into an infinite loop.

```
int k = 7;
int c = 0;
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while (k % 2)
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}
```

- (a) for  $a \leq 1$
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    char *z = s+1;
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        *s = *z;
        s++; z++;
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}
```

Now, suppose we call the function as follows:

```
char s1[] = "abcdef";
...
fs(s1);
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What is the value of s1 after the call?

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  - (b) "badcfe"
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4. What is printed by the following program:

```
int ii = 5;

int fun(int i)
{
    int ii = 2*i;
    i = i % 10;
    return 2*i;
}

void main()
{
    int x;
    x = fun(ii);
    printf("x = %d    ii=%d\n", x, ii);
}
```

- (a)  $x = 0$  and  $ii = 10$
  - (b)  $x = 10$  and  $ii = 10$
  - (c)  $x = 0$  and  $ii = 5$
  - (d)  $x = 10$  and  $ii = 5$
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5. Consider the `malloc()` function. Which one of the following sentences is correct?

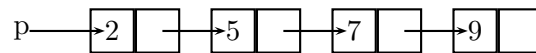
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```
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typedef struct lnode * LIST;

void pf(LIST p)
{
    if (p == 0) return;
    else {
        pf(p->next);
        printf("%d ", p->data);
    }
}
```

Now suppose the list has the following data inside:



What is the output on screen of calling pf() on the above list?

- (a) 2 5 7 9
  - (b) 9
  - (c) 9 7 5 2
  - (d) out of memory
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7. Consider the following function:

```
int fc(char *s)
{
    int n = strlen(s);
    int i;
    for (i=0; i<n/2; i++) {
        if (s[i] != s[n - n/2 + i]) return 0;
    }
    return 1;
}
```

Now suppose that the function is called with the following parameters:

```
x1 = fc("abab");
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Which is the value of x1, x2, x3, x4 after the calls?

- (a)  $x1 = 1, x2 = 0, x3 = 0, x4 = 1$
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8. Consider the following function.

```
int revert(char *str)
{
    int i;
    int l = strlen(str);
    char *copied;

    copied = malloc(l+1);
    strcpy(copied, str);
}
```

```
    for (i = 0; i<l; i++)
        copied[i] = str[l-i-1];

    copied[l] = 0;

    strcpy(str, copied);
    return l;
}
```

The function contains a bug. Can you find it?

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```
int isprime(int a)
{
    int i;
    while (i<a) {
        if (a % i == 0) return 0;
        i++;
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The expected result of `isprime(7)` is 1. However, the function contains a bug. Can you find it?

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```
void sortchars(char *str);
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(Hint: use any of the sorting algorithm seen during the lectures)

---



# Answer Key for Exam | | |---| | B | |---|

## Section 1. Multiple choice questions (4 points each)

1. (a)
2. (c)
3. (d)
4. (d)
5. (c)
6. (c)
7. (a)

## Section 2. Free questions (6 points)

8. **Answer:** The function has a “memory leak”: there is a `malloc()`, but not the corresponding `free()`. Therefore, every time it is called, it will continue to allocate memory without releasing it. If the function is called many times, eventually it will cause a “out of memory” error.
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    int l = strlen(str);
    for (i=0; i<l; i++) {
        for (j=i+1; j<l; j++)
            if (str[i] > str[j]) swapchars(&str[i], &str[j])
    }
}
```