

```
#include <stdlib.h>
#include <string.h>
#include <ctype.h>
```

```
#define MAXPAROLA 30
#define MAXRIGA 80
```

```
int main(int argc, char *argv[])
{
    int freq[MAXPAROLA]; /* vettore di contatori
delle frequenze delle lunghezze delle parole */
    char riga[MAXRIGA];
    int i, inizio, lunghezza;
    FILE *f;
```

```
for(i=0; i<MAXPAROLA; i++)
    freq[i]=0;
```

```
if(argc != 2)
```

```
{
    printf(stderr, "ERRORE: serve un parametro con il nome del file\n");
    exit(1);
}
```

```
f = fopen(argv[1], "r");
if(f==NULL)
```

```
{
    printf(stderr, "ERRORE: impossibile aprire il file %s\n", argv[1]);
    exit(1);
}
```

```
while( fgets( riga, MAXRIGA, f ) != NULL )
```



Algorithms and Data Structures

Common Errors in C Code

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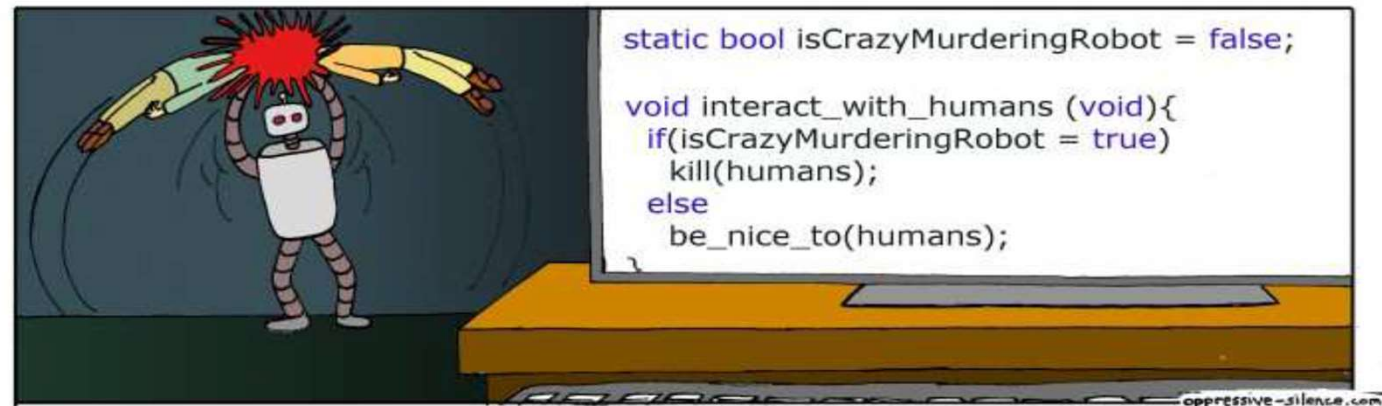
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Test 1 ...

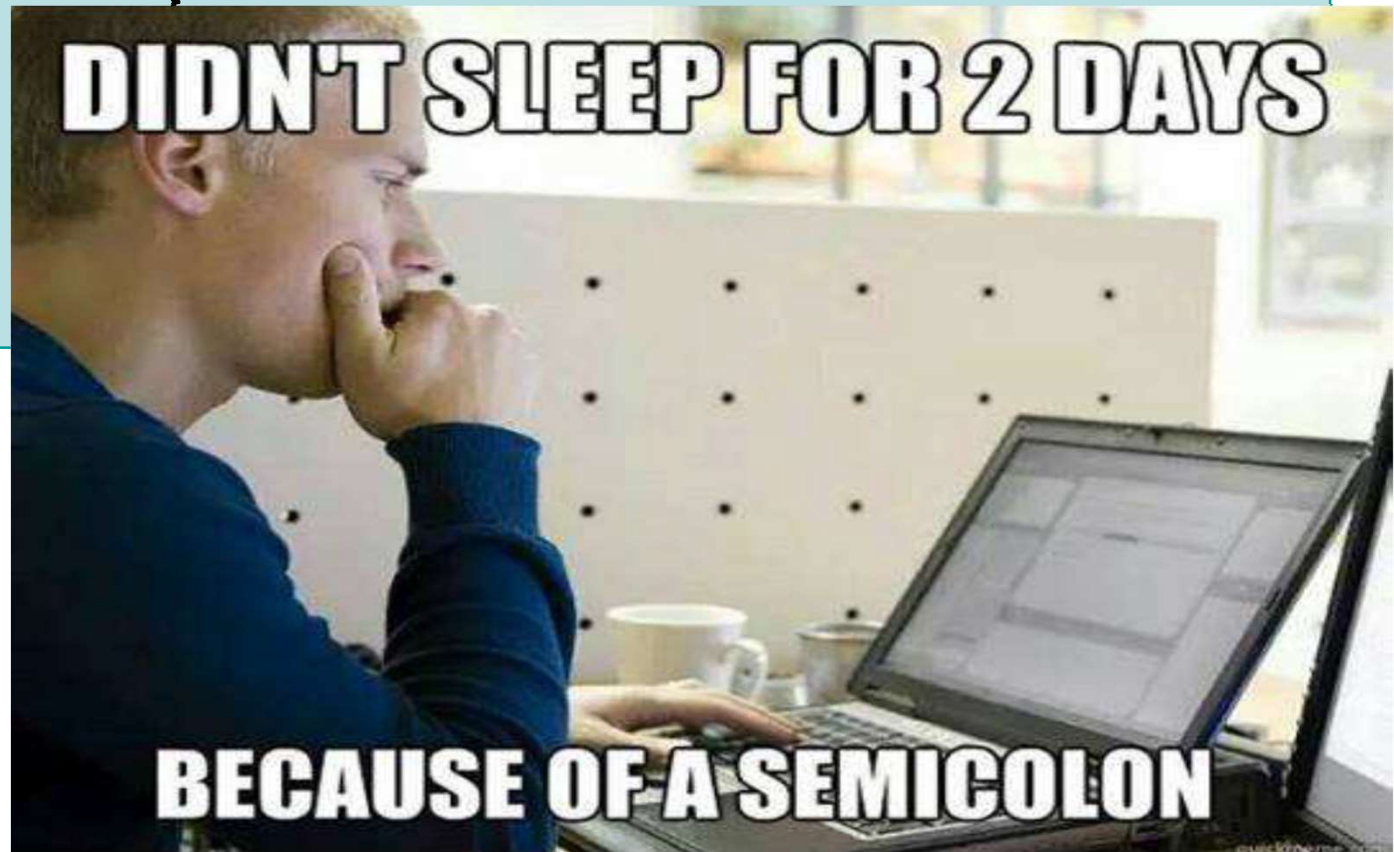
```
1. int i=3, j, k=i, s;  
2. ..  
3. s=i+j; p=i*i;  
4. ...  
5. if (i=3) { ... }  
6. ...  
7. if (k==i);  
8.     i++;  
9. ...
```

- ❖ Which are the errors included in the code snippet above?

```
1. int i=3, j, k=i, s;  
2. ..  
3. s=i+j; p=i*i;  
4. ....  
5. if (i=3) {  
6. ....  
7. if (k==i);  
8.     i++;  
9. ....
```



```
1. int i=3, j, k=i, s;  
2. ..  
3. s=i+j; p=i*i;  
4. ...  
5. if (i=3) {  
6. ...  
7. if (k==i);  
8.     i++;  
9. ...
```



... Test 1

```
1. int i=3, j, k=i, s;  
2. ..  
3. s=i+j; p=i*i;           // No, Uninit j, Undef p  
4. ...  
5. if (i=3) { ... }       // No, = → ==  
6. ...  
7. if (k==i);              // No, ; → no ;  
8.   i++;  
9. ...
```

❖ Be precise

➤ The compiler does not reveal all errors !

Test 2

```
int main () {  
    int n;  
    scanf ("%d", &n);  
    printf ("%d", n);  
    fprintf (stdout, "%d", n);  
    return 1;  
}
```

stdout \leftrightarrow stderr

❖ Questions

- Why there is an & in scanf and not in printf?
- Which is the difference between printf and fprintf?

Test 3

```
int main () {  
    char s[10];  
    scanf ("%s", &s);  
    printf ("%s", s);  
    return 1;  
}
```

❖ Is the code snippet correct?

Test 4 ...

```
int x = 5, i;  
float y = 2, f;
```

```
i = x/y;  
f = x/y;
```

```
printf ("%f %f\n", (float) i, f);
```

❖ What does `printf` print?

... Test 4

```
int x = 5, i;  
float y = 2, f;
```

```
i = x/y;  
f = x/y;
```

```
printf ("%f %f\n", (float) i, f);
```

$j = x \% y;$

is the remainder, i.e., 1

❖ Pay attention to integer divisions

➤ $\frac{N}{D} = q + \frac{R}{D}$

➤ $\frac{5}{2} = 2 + \frac{1}{2}$ **printf** prints 2.0 2.5

N = Numerator
D = Denominator
R = Remainder
Q = Quotient

Possibly, use
`f = ((float)x) / (float)y;`

Test 5 ...

```
int value;  
do {  
    ...  
    value=10;  
} while (!(value==10) || !(value==20))
```

- ❖ Even though value is 10 the program loops
 - Why?


```
int value;  
do {  
    ...  
    value=10;  
} while (!(value==10) || !(value==20))
```

❖ Do not misuse Boolean operators

- The condition given above is a tautology
- It is always true, as value can't be both values at once

... Test 5

```
int value;  
do {  
    ...  
    value=10;  
} while (! (value==10) && ! (value==20))
```



- ❖ It is necessary to use &&
 - Which reads much more nicely: "if value is not equal to 10 and value is not equal to 20", which means if value is some number other than ten or

Test 6 ...

```
1. int i, n;  
2. int v1[5], v2[n];  
3. ..  
4. for (i=1; i<=5; i++)  
5.     scanf ("%d", &v1[j]);
```

❖ Question

➤ Is the code snippet correct?

... Test 6

Possibly, use
`#define N 10`
`int v2[N];`

```
1. int i, n;  
2. int v1[5], v2[n];           // No, n not const  
3. ..  
4. for (i=1; i<=5; i++)       // No, i=0, i<5  
5.     scanf ("%d", &v1[j]);
```

❖ Arrays in C

- Can, at least for now, be defined only of constant size
- Always start at index 0; thus not not overstep array boundaries

Test 7 ...

1. `char c = 'a';`
2. `char c = 21;`
3. `char c = 1234;`
4. `char ch = 'A';`
5. `char ch = "A";`
6. `const char *st = "A";`
7. `const char *st = 'A';`

❖ Q

- Which ones among the previous definitions are correct?

... Test 7

```
1. char c = 'a';           // Correct
2. char c = 21;            // Correct
3. char c = 1234;          // No, OW
4. char ch = 'A';          // Correct
5. char ch = "A";          // No, String
6. const char *st = "A";   // Correct
7. const char *st = 'A';   // No, Char
```

- ❖ C considers character and string constants as very different things
 - Character constants are enclosed in single quotes
 - String constants are enclosed in double quotes
 - String constants act as a pointer to the actually string

Test 8 ...

```
char st1[] = "abc";  
char st2[3] = "abc";  
if (st1 == st2)  
    printf("Yes");  
else  
    printf("No");
```

❖ Question

➤ Is the code snippet correct?

```
char st1[] = "abc";
char st2[3] = "abc";
if (st1 == st2)
    printf("Yes");
else
    printf("No");
```

// No, must include '\0'

a	b	c	\0
---	---	---	----

- ❖ A C string must have a null terminator at the end of the meaningful data in the string

char str[]={'a','b','c'};
is **not** a string

```
char st1[] = "abc";
char st2[3] = "abc";           // No, must include '\0'
if (st1 == st2)                // No, must use strcmp
    printf("Yes");
else
    printf("No");
```

- ❖ A C string must have a null terminator at the end of the meaningful data in the string
 - To manipulate strings use the proper C library function

`if (strcmp(st1, st2) == 0)`

... Test 8

```
char st1[] = "abc";
char st2[3] = "abc";           // No, must include '\0'
if (st1 == st2)                // No, must use strcmp
    printf("Yes");
else
    printf("No");
```

❖ Pay attention to the switch statement

```
switch (str) {
    case "123": ...
    case "ab": ...
}
```

Constants must be
countable

Test 9 ...

```
int main () {  
    menu();  
    ...  
}  
void menu() { ... }
```

❖ Question

➤ Is the code snipped

... Test 9

```
int main () {  
    menu();  
    ...  
}  
void menu() { ... }
```

More details on that
on the ADT and
modularity unit

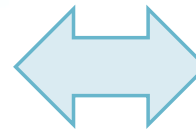
- ❖ The compiler doesn't know what menu stands for until you have told it
 - You cannot wait until after using it to tell it that there's a function
 - Always remember to put either a **prototype** for the function or the entire definition of the function **above** the first time you use the function

Test 10 ...

```
#define SQUARE(x)  x*x  
#define MAX(x,y)   ((x>y)?x:y)
```

```
z = SQUARE(1+2);
```

```
z = MAX(2,5);
```



```
if (x>y)
```

```
    z=x;
```

```
else
```

```
    z=y;
```

```
z=(x>y)?x:y;
```

- ❖ Do not forget the use of macros
 - Macros are simple string replacements
 - So, they will work with preprocessing tokens
- ❖ Use them correctly
 - What does the code print?

... Test 10

```
#define SQUARE(x)  x*x  
#define MAX(x,y)   ((x>y)?x:y)
```

```
z = SQUARE(1+2) ;
```

```
z = MAX(2,5) ;
```

❖ Macro SQUARE computes

➤ $1+2*1+2=5$, not $3*3=9$

➤ Instead, use

```
#define SQUARE(x)  ((x)*(x))
```

Test 11 ...

```
FILE *fp = fopen("test.txt", "r");  
char line[100];  
while (!feof(fp)) {  
    fgets(line, sizeof(line), fp);  
    ...  
}  
fclose(fp);
```

❖ Question

➤ Is the code snippet correct?



```
FILE *fp = fopen("test.txt", "r");
char line[100];
while (!feof(fp)) {
    fgets(line, sizeof(line), fp);
    ...
}
fclose(fp);
```

Mainly, it comes from Pascal
(where it checks the result of
the next instruction)

- ❖ There is a wide spread misunderstanding of how C's **feof** function works
 - The function returns true if the last function failed
 - The program will print the last line of the input file **twice**

... Test 11

❖ Use the following code instead

```
while (1) {  
    fgets(line, sizeof(line), fp);  
    if (feof(fp))  
        break;  
    ...  
}  
fclose(fp);
```

```
while (fgets(line, sizeof(line), fp) != NULL) {  
    ...  
}  
fclose(fp);
```

Or
`while (fscanf (fp, ...) != EOF) {...}`

Test 12 ...

```
char *st;  
strcpy (st, "abc");
```

❖ Question

➤ Is the code snippet correct?



```
char *st;                                // st points to nothing
strcpy (st, "abc");
```

- ❖ Anytime you use a pointer, you should be able to answer the question
 - What variable does this point to?
 - If you can not answer this question, it is likely it doesn't point to any variable
 - This type of error will often result in a Segmentation fault/coredump error on UNIX/Linux or a general protection fault under Windows

... Test 12

```
char *st;                                // st points to nothing
strcpy (st, "abc");
```

❖ You need to use

- Dynamic memory allocation
- Function **strdup** (which is the same)

First topic of "Algorithm and Data Structures"

```
char *st;
st = strdup ("abc");
```