

```
#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)
```

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

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

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

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



# Synchronization

## Synchronization in C

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This slide introduces the topic of synchronization in C, which is crucial for managing access to shared resources in concurrent programming.

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# Semaphore implementations

## ❖ Mutexes in C are

- Represented by object of type **mtx\_t**
- Defined in `threads.h`, i.e., insert
  - `#include <threads.h>`

Representation: Mutexes are represented by objects of type `mtx_t`.  
Header File: Defined in `threads.h`, so you need to include this header file using `#include <threads.h>`.

## ❖ See documentation for

- Atomic operation and fences (barriers) in C

Barriers are introduced in  
unit 06 section 07

For more operations see the  
reference documentation

## Table of Functions:

```
int mtx_init(mtx_t *mtx, int mtxtype);
```

Meaning: Create a mutex (mtx) with some properties (mtxtype).

```
void mtx_destroy(mtx_t *mtx);
```

Meaning: Destroy the mutex pointed to by mtx.

```
int mtx_lock(mtx_t *mtx);
```

Meaning: Blocks the calling thread until it obtains the mutex referenced by mtx.

```
int mtx_trylock(mtx_t *mtx);
```

Meaning: Try to obtain the mutex referenced by mtx without blocking the thread.

```
int mtx_timedlock(mtx_t *mtx, const struct timespec *ts);
```

Meaning: Try to obtain the mutex referenced by mtx but blocks the thread only for a specific time.

```
int mtx_unlock(mtx_t *mtx);
```

Meaning: Releases the mutex referenced by mtx.

## Mutual exclusion

Type	Meaning
<code>int mtx_init(mtx_t *mtx, int muxtype);</code>	Create a mutex (mtx) with some properties (muxtype).
<code>void mtx_destroy(mtx *mtx);</code>	Destrpy the mutex pointed by mtx.
<code>int mtx_lock(mtx_t *mtx);</code>	Blocks the calling thread until it obtain the mutex referenced by mtx.
<code>int mtx_trylock(mtx_t *mtx);</code>	Try to obtain the mutex referenced by mtx but it does not block the thread.
<code>int mtx_timedlock(mtx_t *mtx, cont struct timespec *ts);</code>	Try to obtain the mutex referenced by mtx but it blocks the thread only for a specific time.
<code>int mtx_unlock(mtx_x *mtx);</code>	Releases the mutex referred by mtx.

This slide provides a summary of the functions used to manage mutexes in C. Here's a detailed explanation of each function:

1. `mtx_init`:

Purpose: Initializes a mutex with specified properties.

Parameters:

`mtx_t *mtx`: Pointer to the mutex to be initialized.

`int mtxtype`: Properties of the mutex (e.g., whether it is recursive).

```
mtx_t myMutex;
```

```
mtx_init(&myMutex, mtx_plain); // Initializes a plain mutex
```

`mtx_destroy`:

Purpose: Destroys a mutex, freeing any resources it may be using.

Parameters:

`mtx_t *mtx`: Pointer to the mutex to be destroyed.

Usage: