Operating Systems (CS3000)

Lecture – 16

(Inter Process Communication - 2)

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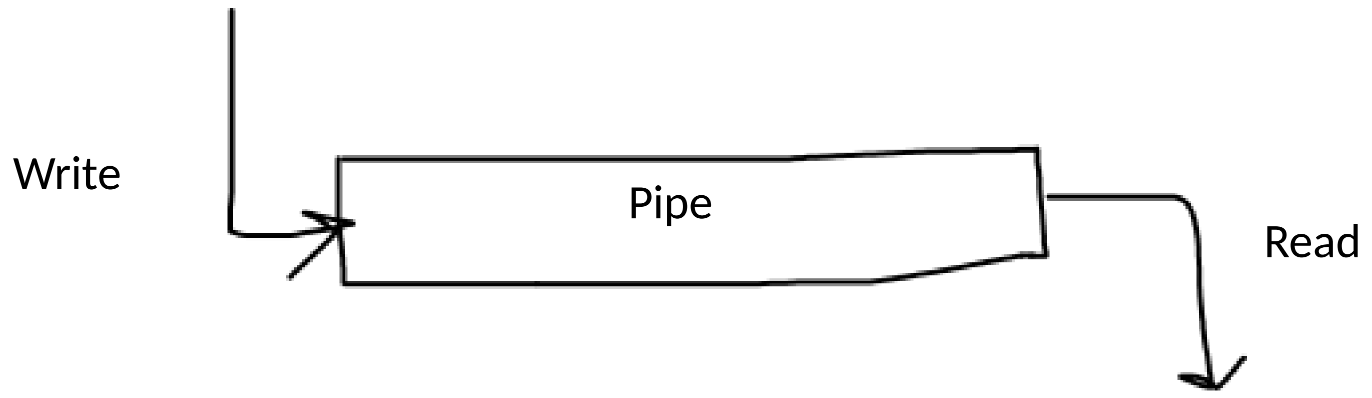
Message Passing using Pipes

- Pipe is a communication between parent and child process
- Communication is achieved by one process writing into the pipe and other reading from the pipe
- To achieve the pipe system call, create two descriptors, one to write into the file and another to read from the file.
- Patent [illegible] Child



Creating Pipe between Parent and Child process

- **int pipe**(int **pipefd[2]**);
- a file descriptor is used to access the two ends of the pipe: one end for reading and one end for writing
  - pipefd[0] is the file descriptor for reading.
  - pipefd[1] is the file descriptor for writing.
- Returns zero on success
- Returns -1 in case of failure

Message Passing using Pipes

- **ssize_t read**(int **fd**, void ***buf**, size_t **count**)

  - The file descriptor to read from.
  - A pointer to a buffer where the read data will be stored.
  - The maximum number of bytes to read.

- Returns the number of bytes read
- Returns -1 in case of failure

Message Passing using Pipes

- **ssize_t** **write**(int fd, void *buf, size_t **count**)

  - The file descriptor to write to.
  - A pointer to a buffer where the write data will be stored.
  - The maximum number of bytes to write.
- Return the number of bytes written
- Return zero in case nothing is written
- Return -1 in case of failure

Message Passing using Pipes

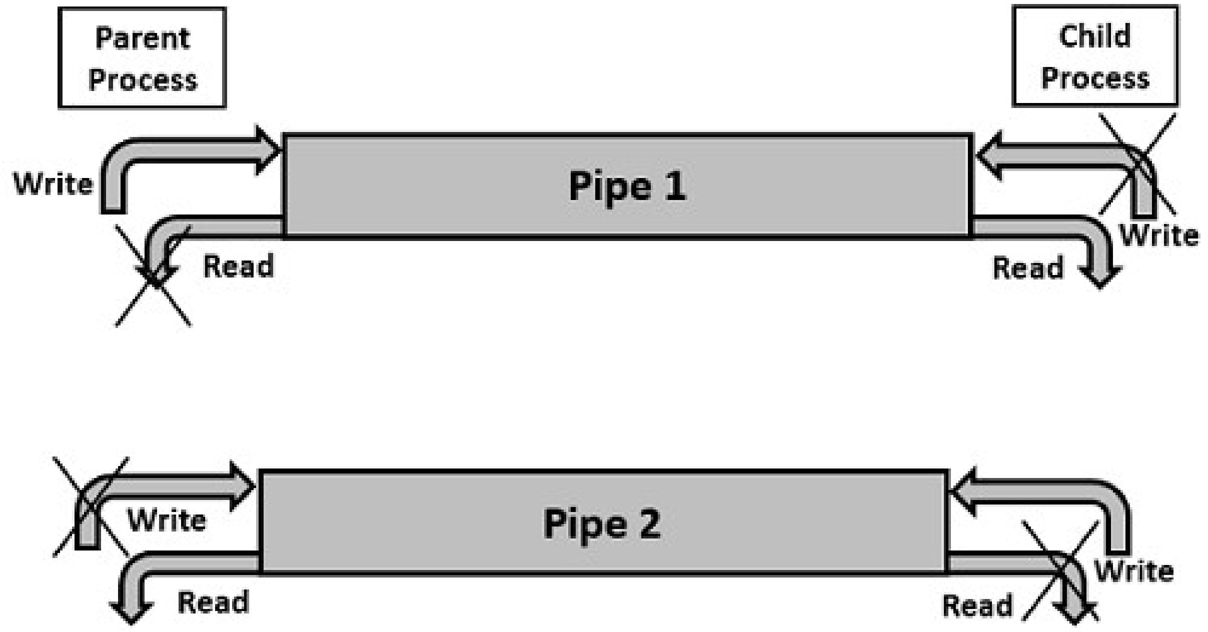
- **_int close**(int fd)
  - Closing the pipe end.
- Return zero on success
- Return -1 in case of failure

Message Passing using Pipes

- Algorithm
- **Step 1** − Create a pipe
- **Step 2** − Create a child process
- **Step 3** − Parent process writes to the pipe
- **Step 4** − Child process retrieves the message from the pipe and writes it to the standard output
- **Step 5** − Repeat step 3 and step 4 once again

Two-way Communication Using Pipes

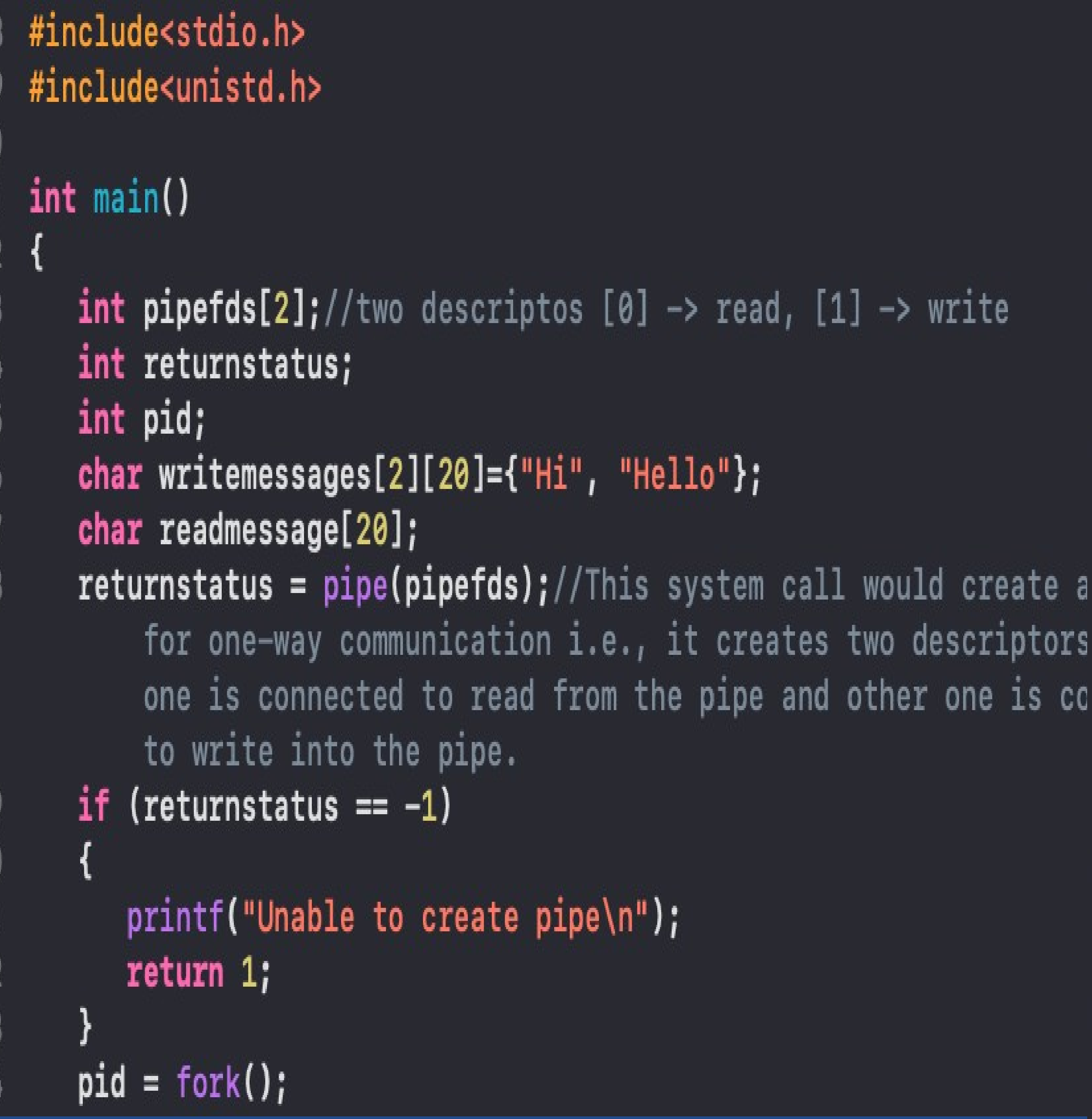
- If both the parent and the child needs to write and read from the pipes simultaneously
  - Two pipes are required



Two-way Communication Using Pipes

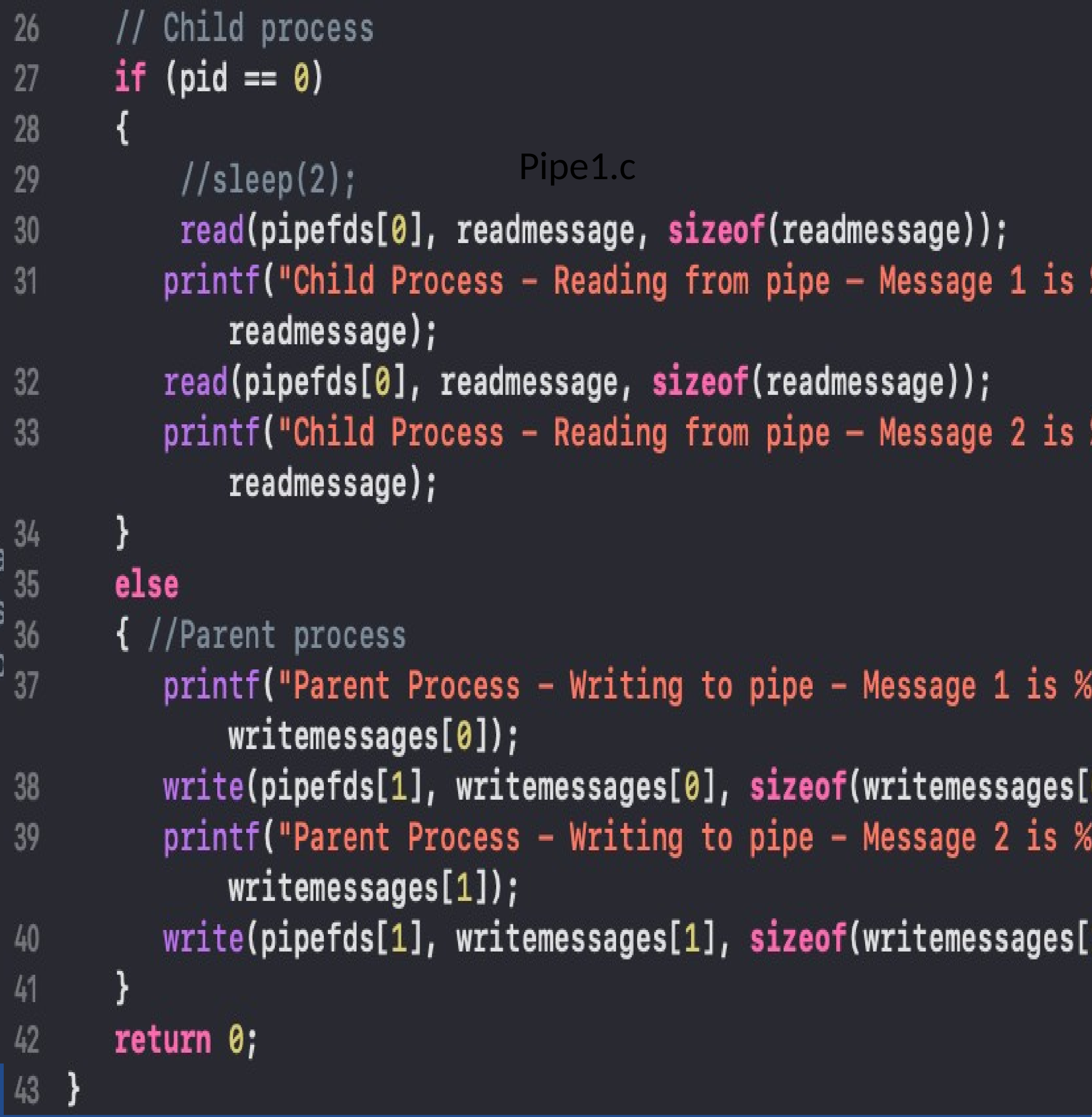
- Algorithm
- **Step 1** − Create pipe1 for the parent process to write and the child process to read
- **Step 2** − Create pipe2 for the child process to write and the parent process to read
- **Step 3** − Close the unwanted ends of the pipe from the parent and child side
- **Step 4** − Parent process to write a message and child process to read and display on the screen
- **Step 5** − Child process to write a message and parent process to read and display on the screen

Pipe1.c



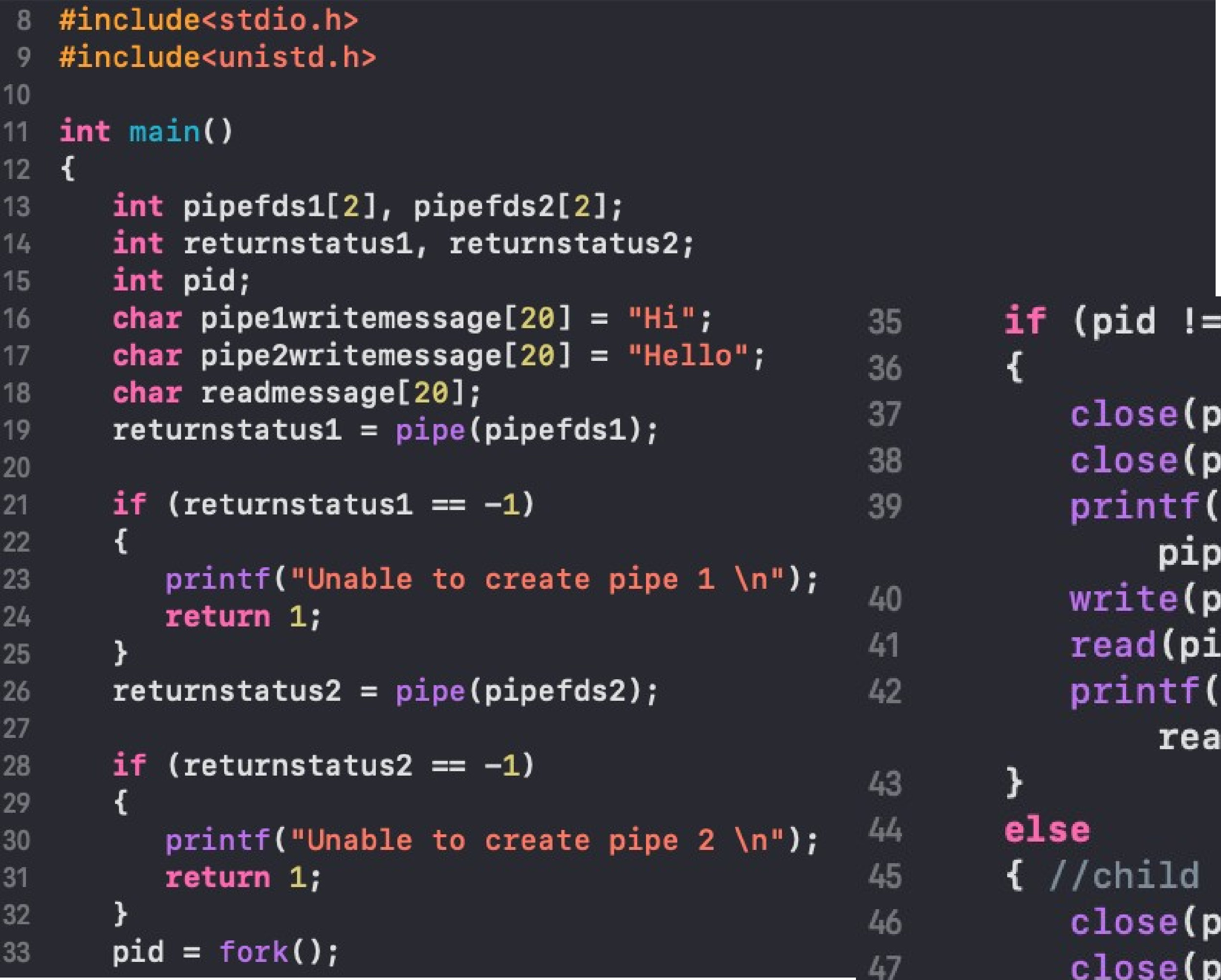
```
#include<stdio.h>
#include<unistd.h>

int main()
{
   int pipefds[2];//two descriptos [0] -> read, [1] -> write
   int returnstatus;
   int pid;
   char writemessages[2][20]={"Hi", "Hello"};
   char readmessage[20];
   returnstatus = pipe(pipefds);//This system call would create a
      for one-way communication i.e., it creates two descriptors
      one is connected to read from the pipe and other one is co
      to write into the pipe.
   if (returnstatus == -1)
   {
      printf("Unable to create pipe\n");
      return 1;
   }
   pid = fork();
```



```
   // Child process
   if (pid == 0)
   {
       //sleep(2);
       read(pipefds[0], readmessage, sizeof(readmessage));
      printf("Child Process - Reading from pipe - Message 1 is 
         readmessage);
      read(pipefds[0], readmessage, sizeof(readmessage));
      printf("Child Process - Reading from pipe - Message 2 is 
         readmessage);
   }
   else
   { //Parent process
      printf("Parent Process - Writing to pipe - Message 1 is %
         writemessages[0]);
      write(pipefds[1], writemessages[0], sizeof(writemessages[
      printf("Parent Process - Writing to pipe - Message 2 is %
         writemessages[1]);
      write(pipefds[1], writemessages[1], sizeof(writemessages[
   }
   return 0;
}
```

Pipe2.c

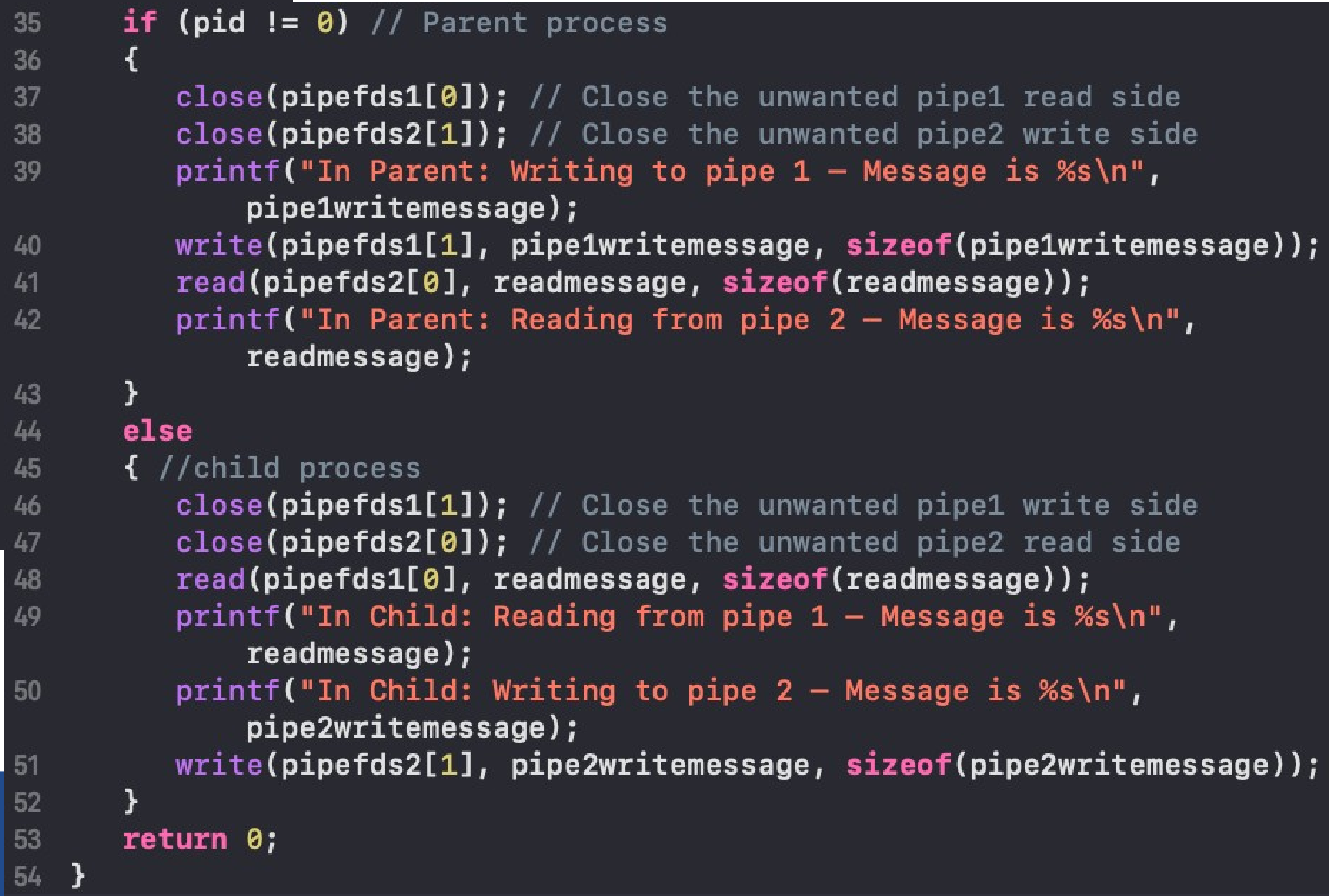


```c
#include<stdio.h>
#include<unistd.h>

int main()
{
   int pipefds1[2], pipefds2[2];
   int returnstatus1, returnstatus2;
   int pid;
   char pipe1writemessage[20] = "Hi";
   char pipe2writemessage[20] = "Hello";
   char readmessage[20];
   returnstatus1 = pipe(pipefds1);

   if (returnstatus1 == -1)
   {
      printf("Unable to create pipe 1 \n");
      return 1;
   }
   returnstatus2 = pipe(pipefds2);

   if (returnstatus2 == -1)
   {
      printf("Unable to create pipe 2 \n");
      return 1;
   }
   pid = fork();
```



```c
   if (pid != 0) // Parent process
   {
      close(pipefds1[0]); // Close the unwanted pipe1 read side
      close(pipefds2[1]); // Close the unwanted pipe2 write side
      printf("In Parent: Writing to pipe 1 – Message is %s\n",
          pipe1writemessage);
      write(pipefds1[1], pipe1writemessage, sizeof(pipe1writemessage));
      read(pipefds2[0], readmessage, sizeof(readmessage));
      printf("In Parent: Reading from pipe 2 – Message is %s\n",
          readmessage);
   }
   else
   { //child process
      close(pipefds1[1]); // Close the unwanted pipe1 write side
      close(pipefds2[0]); // Close the unwanted pipe2 read side
      read(pipefds1[0], readmessage, sizeof(readmessage));
      printf("In Child: Reading from pipe 1 – Message is %s\n",
          readmessage);
      printf("In Child: Writing to pipe 2 – Message is %s\n",
          pipe2writemessage);
      write(pipefds2[1], pipe2writemessage, sizeof(pipe2writemessage));
   }
   return 0;
}
```

Thank You

Any Questions?