OSL
Assignment – 2A

Process Control System Calls

Roll no: 33245

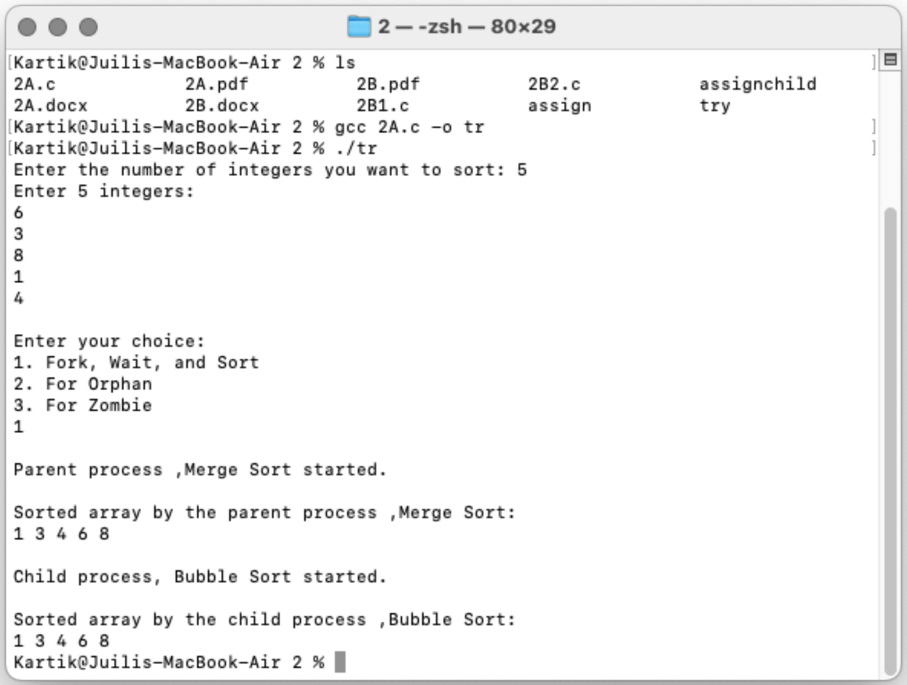
CODE:

```
#include <stdio.h>
#include <stdlib.h>
#include <sys/types.h>
#include <sys/wait.h>
#include <unistd.h>
// Bubble Sort
void bubbleSort(int arr[], int n)
{
    int temp, i, j;
    for (i = 0; i < n - 1; i++)
    {
        for (j = 0; j < n - i - 1; j++)
        {
            if (arr[j] > arr[j + 1])
            {
                temp = arr[j];
                arr[j] = arr[j + 1];
                arr[j + 1] = temp;
            }
        }
    }
}
// Merge Sort
void merge(int arr[], int l, int m, int r)
{
    int i, j, k;
    int n1 = m - l + 1;
    int n2 = r - m;
    int L[n1], R[n2];
    for (i = 0; i < n1; i++)
        L[i] = arr[l + i];
    for (j = 0; j < n2; j++)
        R[j] = arr[m + 1 + j];
    i = 0;
    j = 0;
    k = l;
    while (i < n1 && j < n2)
    {
        if (L[i] <= R[j])
        {
            arr[k] = L[i];
            i++;
        }
        else
        {
            arr[k] = R[j];
            j++;
        }
        k++;
    }
    while (i < n1)
    {
        arr[k] = L[i];
        i++;
        k++;
    }
    while (j < n2)
    {
        arr[k] = R[j];
        j++;
        k++;
    }
}
void mergeSort(int arr[], int l, int r)
{
    if (l < r)
    {
        int m = l + (r - l) / 2;
        mergeSort(arr, l, m);
        mergeSort(arr, m + 1, r);
        merge(arr, l, m, r);
    }
}
int main()
{
    int n, i;
    printf("Enter the number of integers you want to sort: ");
    scanf("%d", &n);

    int arr[n];
```

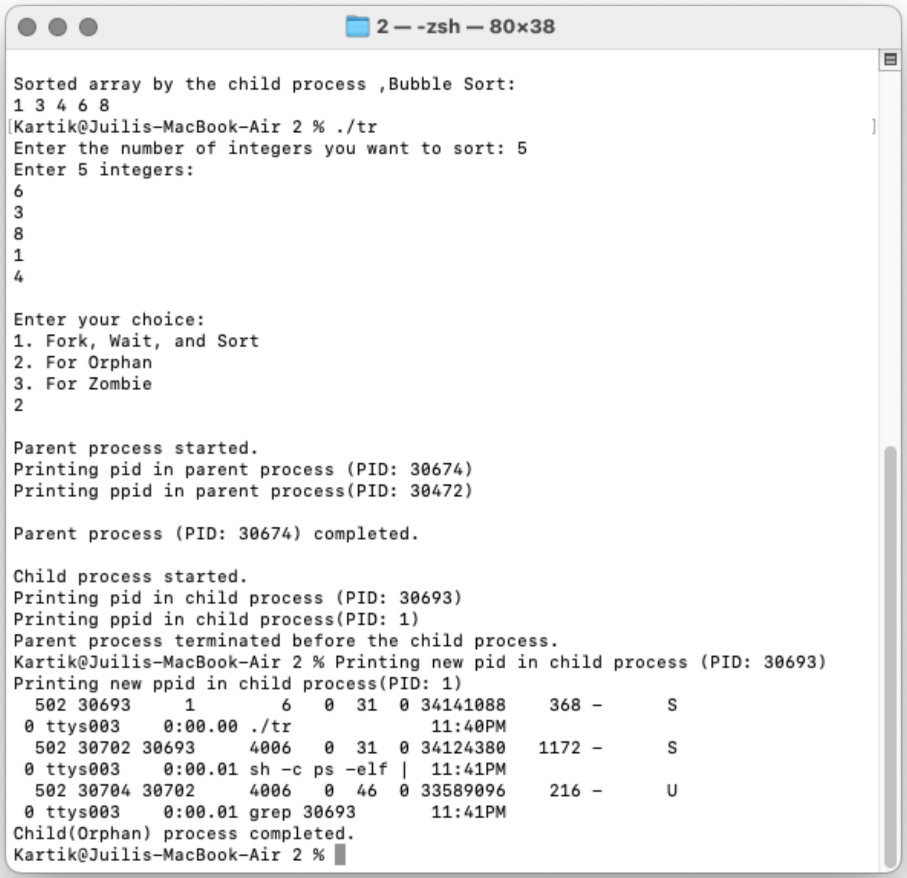
```
printf("Enter %d integers:\n", n);

for (i = 0; i < n; i++)
{
    scanf("%d", &arr[i]);
}
int choice;
printf("\nEnter your choice:\n");
printf("1. Fork, Wait, and Sort\n");
printf("2. For Orphan\n");
printf("3. For Zombie\n");
scanf("%d", &choice);
switch (choice)
{
case 1:
{
    pid_t pid = fork();
    if (pid < 0)
    {
        printf("Fork failed.\n");
        exit(1);
    }
    else if (pid == 0)
    {
        printf("\nChild process, Bubble Sort started.\n");
        bubbleSort(arr, n);
        printf("\nSorted array by the child process ,Bubble Sort:\n");
        for (i = 0; i < n; i++)
            printf("%d ", arr[i]);
        printf("\n");
    }
    else
    {
        printf("\nParent process ,Merge Sort started.\n");
        mergeSort(arr, 0, n - 1);
        printf("\nSorted array by the parent process ,Merge Sort:\n");
        for (i = 0; i < n; i++)
            printf("%d ", arr[i]);
        printf("\n");
        wait(NULL);
    }
    break;
}
case 2:
{
        pid_t pid = fork();
        if (pid < 0)
        {
            printf("Fork failed.\n");
            exit(1);
        }
        else if (pid == 0)
        {
            // Orphan process
            printf("\nChild process started.\n");
            printf("Printing pid in child process (PID: %d)\n", getpid());
            printf("Printing ppid in child process(PID: %d) \n", getppid());
            printf("Parent process terminated before the child process.\n");
            sleep(5);
            printf("Printing new pid in child process (PID: %d)\n", getpid());
            printf("Printing new ppid in child process(PID: %d) \n",
getppid());
            char command[100];
            sprintf(command, "ps -elf | grep %d", getpid());
            system(command);
            printf("Child(Orphan) process completed.\n");
            wait(NULL);
        }
        else
        {
            // Parent process
            printf("\nParent process started.\n");
            printf("Printing pid in parent process (PID: %d)\n", getpid());
            printf("Printing ppid in parent process(PID: %d) \n", getppid());
            printf("\nParent process (PID: %d) completed.\n", getpid());
        }
        break;
    }
    case 3:
    {
        pid_t pid = fork();
        if (pid < 0)
        {
            printf("Fork failed.\n");
            exit(1);
        }
        else if (pid == 0)
        {
            // Child process
            printf("\nChild process started.\n");
```

```c
            printf("\nPrinting pid in child process (PID: %d)\n", getpid());
            printf("\nPrinting ppid in child process(PID: %d) \n", getppid());
        }
        else
        {
            // Parent process
            printf("\nParent process started.\n");
            printf("Parent process will sleep to create a Zombie.\n");
            sleep(10);
            char command[100];
            sprintf(command, "ps -elf | grep %d", getpid());
            system(command);
            // The parent process will complete before calling wait.
            printf("\nParent process (PID: %d) completed.\n", getpid());
            wait(NULL);
        }
        break;
    }
    default:
        printf("Invalid choice.\n");
        break;
    }
    return 0;
}
```

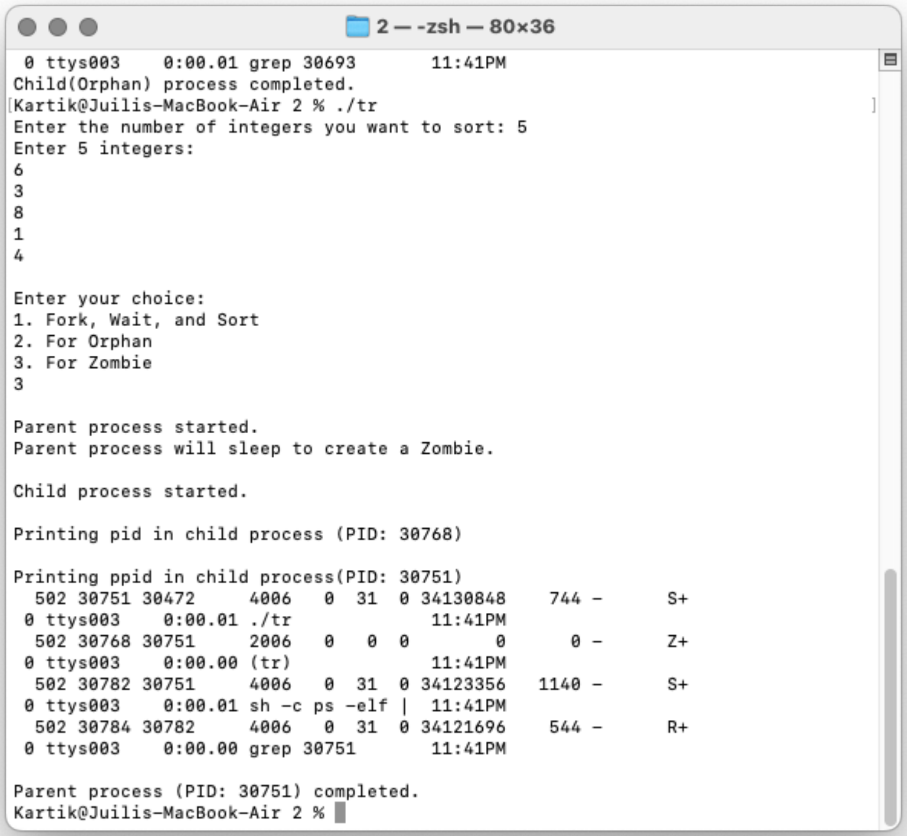
OUTPUT



```
Kartik@Juilis-MacBook-Air 2 % ls
2A.c            2A.pdf          2B.pdf          2B2.c           assignchild
2A.docx         2B.docx         2B1.c           assign          try
Kartik@Juilis-MacBook-Air 2 % gcc 2A.c -o tr
Kartik@Juilis-MacBook-Air 2 % ./tr
Enter the number of integers you want to sort: 5
Enter 5 integers:
6
3
8
1
4

Enter your choice:
1. Fork, Wait, and Sort
2. For Orphan
3. For Zombie
1

Parent process ,Merge Sort started.

Sorted array by the parent process ,Merge Sort:
1 3 4 6 8

Child process, Bubble Sort started.

Sorted array by the child process ,Bubble Sort:
1 3 4 6 8
Kartik@Juilis-MacBook-Air 2 %
```



```
Sorted array by the child process ,Bubble Sort:
1 3 4 6 8
Kartik@Juilis-MacBook-Air 2 % ./tr
Enter the number of integers you want to sort: 5
Enter 5 integers:
6
3
8
1
4

Enter your choice:
1. Fork, Wait, and Sort
2. For Orphan
3. For Zombie
2

Parent process started.
Printing pid in parent process (PID: 30674)
Printing ppid in parent process(PID: 30472)

Parent process (PID: 30674) completed.

Child process started.
Printing pid in child process (PID: 30693)
Printing ppid in child process(PID: 1)
Parent process terminated before the child process.
Kartik@Juilis-MacBook-Air 2 % Printing new pid in child process (PID: 30693)
Printing new ppid in child process(PID: 1)
  502 30693     1        6   0  31   0 34141088    368 -      S
 0 ttys003    0:00.00 ./tr              11:40PM
  502 30702 30693     4006   0  31   0 34124380   1172 -      S
 0 ttys003    0:00.01 sh -c ps -elf |  11:41PM
  502 30704 30702     4006   0  46   0 33589096    216 -      U
 0 ttys003    0:00.01 grep 30693       11:41PM
Child(Orphan) process completed.
Kartik@Juilis-MacBook-Air 2 %
```



```
 0 ttys003    0:00.01 grep 30693       11:41PM
Child(Orphan) process completed.
Kartik@Juilis-MacBook-Air 2 % ./tr
Enter the number of integers you want to sort: 5
Enter 5 integers:
6
3
8
1
4

Enter your choice:
1. Fork, Wait, and Sort
2. For Orphan
3. For Zombie
3

Parent process started.
Parent process will sleep to create a Zombie.

Child process started.

Printing pid in child process (PID: 30768)

Printing ppid in child process(PID: 30751)
  502 30751 30472     4006   0  31   0 34130848    744 -      S+
 0 ttys003    0:00.01 ./tr              11:41PM
  502 30768 30751     2006   0   0   0        0      0 -      Z+
 0 ttys003    0:00.00 (tr)              11:41PM
  502 30782 30751     4006   0  31   0 34123356   1140 -      S+
 0 ttys003    0:00.01 sh -c ps -elf |  11:41PM
  502 30784 30782     4006   0  31   0 34121696    544 -      R+
 0 ttys003    0:00.00 grep 30751       11:41PM

Parent process (PID: 30751) completed.
Kartik@Juilis-MacBook-Air 2 %
```