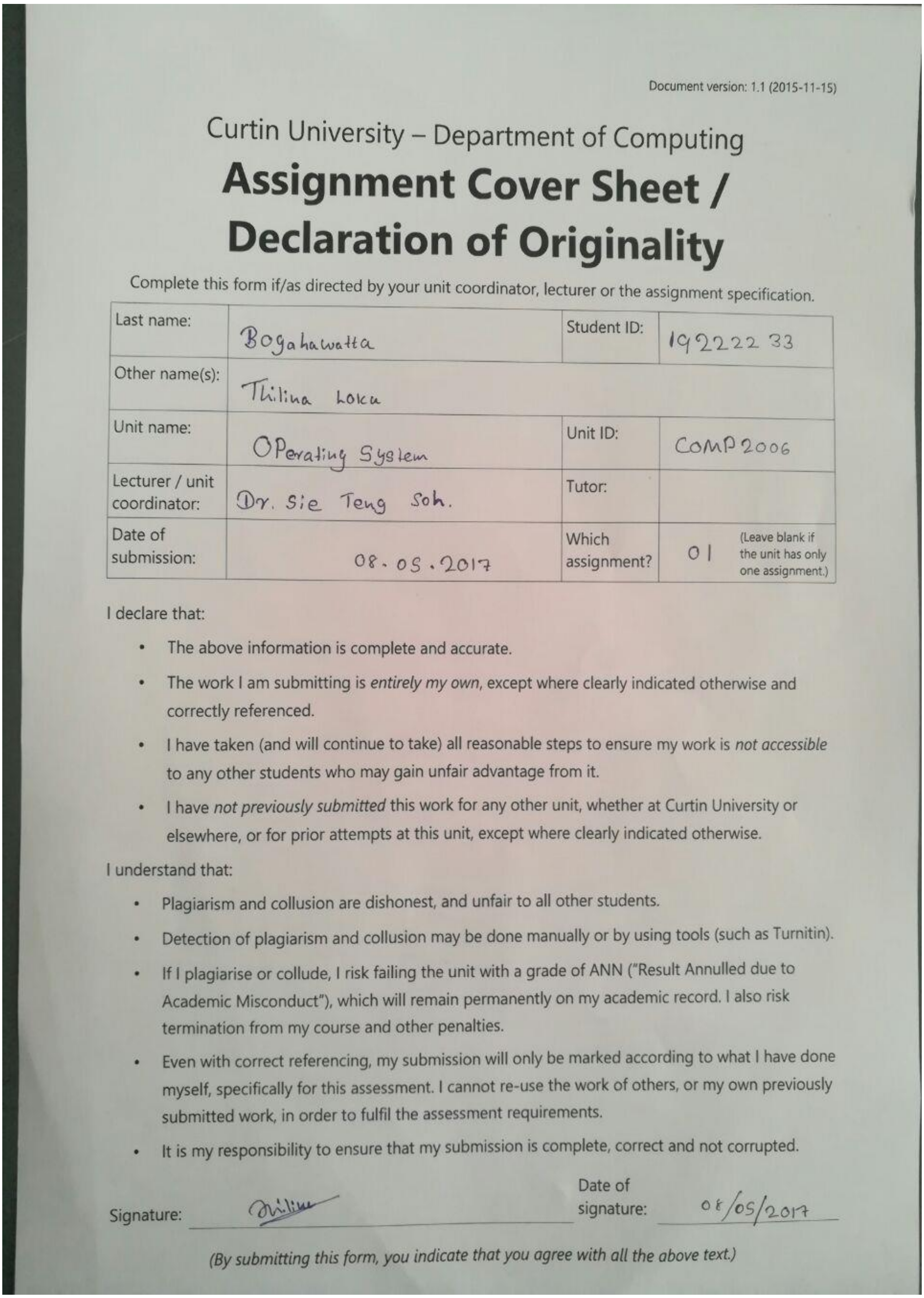

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Curtin University – Department of Computing

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Other name(s):	Thilina Loku		
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Lecturer / unit coordinator:	Dr. Sie Teng Soh.	Tutor:	
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Curtin University

Multitasked Sudoku Solution Validator

Operating Systems

Assignment 2017

Submitted by
Thilina Loku Bogahawatta

CURTIN ID : 19222233
SLIIT ID : IT15005786

Table of content

1. Introduction

We need to implement a program by using C programming language for Multitasked Sudoku Solution Validator. As well as this program uses command line arguments to get the inputs for the program. There are two parts. So we implement same validation programme by two different ways, by using processes and threads.

2. Source code

2.1 Processes

```
        #include<stdlib.h>
#include<stdio.h>               /* exit(), malloc(), free() */
#include<sys/types.h>           /* key_t, sem_t, pid_t */
#include<sys/shm.h>             /* shmat(), IPC_RMID*/
#include<semaphore.h>           /* sem_open(), sem_destroy(),
sem_wait()*/
#include<fcntl.h>               /* O_CREAT, O_EXEC */


typedef struct structure{
int pid;

}subt;

int M,N;
int *Buffer1;
int segid1,y=1,number1;
int i,j,l;
FILE *file1;
int c,d,forvalue;
sem_t *sem;
unsigned int semValue;
int *temp;
int results[9]={0};
int results2[9]={0};


int main(int argc,char *argv[]){
```

```
subt *sub;

/*Getting command line arguments*/

M=atoi(argv[2]);
N=atoi(argv[3]);

/*Creating and attaching Buffer1, shared memory */

if((segid1=shmget(2000000000,sizeof(int)*M*N,IPC_CREAT|06
66))<0)
{
perror("shmget1");
exit(1);
}

if((Buffer1=(int *)shmat(segid1,NULL,0))<0){
perror("shmat");
exit(1);

}


semValue=1;
/*Semphore value, if this value is changed to 0
 * it dosen't  access to cririical section
/* initialize semaphores for shared processes */
sem=sem_open("PSEM",O_CREAT|O_EXCL,0644,semValue);
/* name of semaphore is "pSem", semaphore is reached using
this name */
sem_unlink("PSEM");/* unlink prevents the semaphore existing
forever
/* if a crash occurs during the execution
```

```
/*Opening files */
file1=fopen(argv[1],"r");

if(file1==NULL ){

         printf("File open Failed!!");
         exit(1);

}

for(i=0;i<M;i++){
         for(j=0;j<N;j++){
          if(fscanf(file1,"%d",&number1)!=EOF){
                  Buffer1[i*N+j]=number1;
          }
         }
}



printf("    TABLE  \n");

for(i=0;i<M;i++){
         for(j=0;j<N;j++){

          printf("  %d",Buffer1[i*N+j]);

         }
printf("\n");
}
```

```
  for(i=0;i<=M;i++){


        sub->pid=fork();

        if(i==9){

                if(sub->pid==0){
                printf("Validation_Result_from_Process
(%d):%d\n",i+1,getpid());
                printf("Columns %d of %d Valid  \n",i,i);

                // columns cheak
                for(j=0;j<N;j++){


                        int tmp;

                        int array_value= Buffer1[i*N+j];

                        if(results2[0]==0){

                                results2[0]=array_value;




                        }else
                        {
                        }

                        int n=sizeof(results2);

                        for(l=1;l<=8;l++){



                        if(results2[l]==array_value){

                                printf("Invalid Columns: %d",results2[j]);

                        }else{

                                results2[l]=array_value;


                        }

                        }



                        }

        }

                }


                }
        else{
        int sum2=0;
        if(sub->pid<0){

        printf("Error");
        }

        else if(sub->pid==0)
                {
                sem_wait(sem);

printf("Validation_Result_from_Process
(%d):%d\n",i+1,getpid());


                //row cheaking
                for(j=0;j<N;j++){


                        int tmp;

                        int array_value= Buffer1[i*N+j];

                        if(results[0]==0){

                                results[0]=array_value;




                        }else
                        {
```

```
                    int n=sizeof(results);

                    for(l=1;l<=8;l++){



                    if(results[l]==array_value){

                        printf("Invalid Row: %d",results[j]);

                    }else{

                        results[l]=array_value;


                    }

                    }


                    }

            }
        printf("Row %d is Valid \n",i+1);



                printf("\n");
                sem_post(sem);
                exit(0);
```

```
                    }

                else
                {
                wait(NULL);
                }
        }

        }
        sem_destroy(sem);
        }
```

2.2 Threads

```
#include <stdlib.h>

#include <stdio.h>

#include <pthread.h>


int number1,i,j,M,N,K;

int A[9][9]; //Initializing arrays by setting default values

FILE *file1;

/* The mutex lock */


pthread_mutex_t mutex;

pthread_t tidp,tidc[9];      //Thread ID

pthread_attr_t attr; //Set of thread attributes
```

```
void *producer(void *param); /* the producer thread */
void *consumer(void *param); /* the consumer thread */

/* Producer Thread */

void *producer(void *param ) {



pthread_mutex_lock(&mutex); //acquire the mutex lock

//Get data from the textfiles

for(i=0;i<M;i++){
        for(j=0;j<N;j++){
                if(fscanf(file1,"%d",&number1)!=EOF){
                A[i][j]=number1;
        }
        }
}



pthread_mutex_unlock(&mutex); //release the mutex lock
pthread_exit(0);
}

void *consumer(void *param) {

pthread_mutex_lock(&mutex); //acquire the mutex lock

int va=(int)param;

for(j=0;j<K;j++){

sum2=sum2+A[va][j];
}
printf("\nValidation_Result_from_Thread (%d):%d\n",va+1,tidc[va]);




pthread_mutex_unlock(&mutex); //release the mutex lock
pthread_exit(0);
}
```

```
int main(int argc,char *argv[] ){


file1=fopen(argv[1],"r");
M=atoi(argv[2]);
N=atoi(argv[3]);



A[M][N];


/* Create the mutex lock */
pthread_mutex_init(&mutex,NULL);
/*Create the thread*/
pthread_create(&tidp,NULL,producer,NULL);


pthread_join(tidp,NULL);


printf("   TABLE  \n");
for(i=0;i<M;i++){
        for(j=0;j<N;j++){
          printf("%d ",A[i][j]);
        }
printf("\n");
}
int r=0;
/*Create the thread*/
for(r=0;r<M;r++){
        pthread_create(&tidc[r],NULL,consumer,(void*)r);
}
for(r=0;r<M;r++){
        pthread_join(tidc[r],NULL);
}


pthread_mutex_destroy(&mutex);
pthread_exit(0);


}
```

3. How to compile

3.1 Processes

To compile **gcc –opro OS_Proccess.c –lpthread**

Then **./pro data1.txt 9 9**

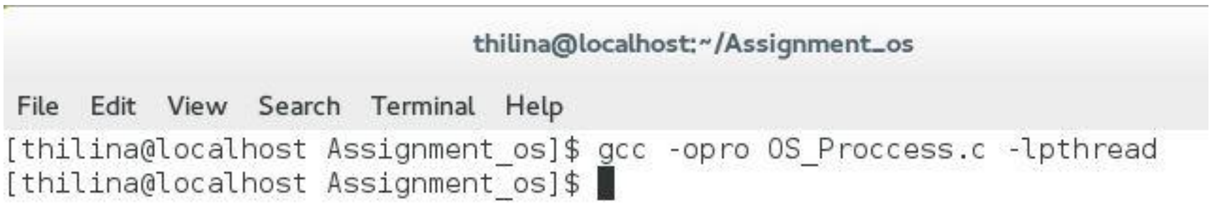
3.2 Threads

To compile **gcc –othr OS_thread.c –lpthread**

Then **./thr data1.txt 9 9**

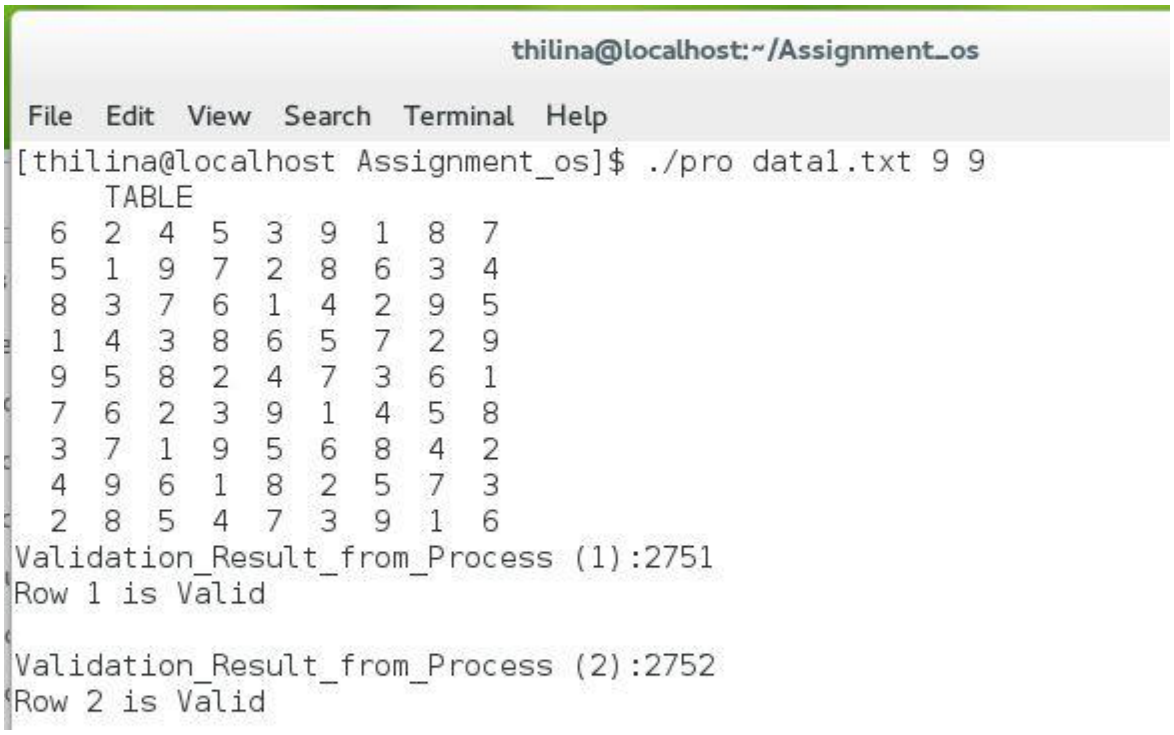
4. **Screenshots**

4.1 Processes


thilina@localhost:~/Assignment_os
File Edit View Search Terminal Help

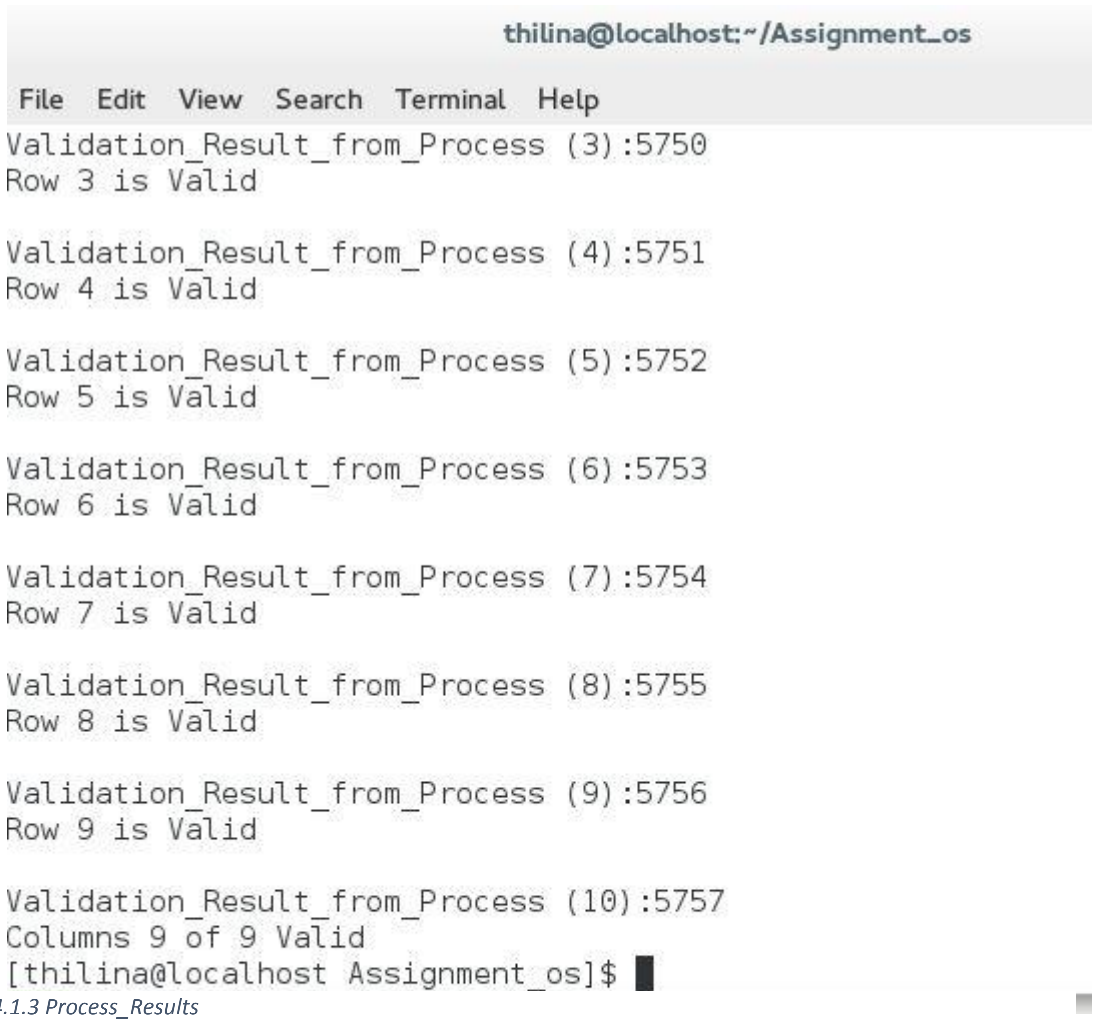
```
[thilina@localhost Assignment_os]$ gcc -opro OS_Proccess.c -lpthread
[thilina@localhost Assignment_os]$ 
```

4.1.1 Process Compile


thilina@localhost:~/Assignment_os
File Edit View Search Terminal Help

```
[thilina@localhost Assignment_os]$ ./pro data1.txt 9 9
     TABLE
  6  2  4  5  3  9  1  8  7
  5  1  9  7  2  8  6  3  4
  8  3  7  6  1  4  2  9  5
  1  4  3  8  6  5  7  2  9
  9  5  8  2  4  7  3  6  1
  7  6  2  3  9  1  4  5  8
  3  7  1  9  5  6  8  4  2
  4  9  6  1  8  2  5  7  3
  2  8  5  4  7  3  9  1  6
Validation_Result_from_Process (1):2751
Row 1 is Valid

Validation_Result_from_Process (2):2752
Row 2 is Valid
```

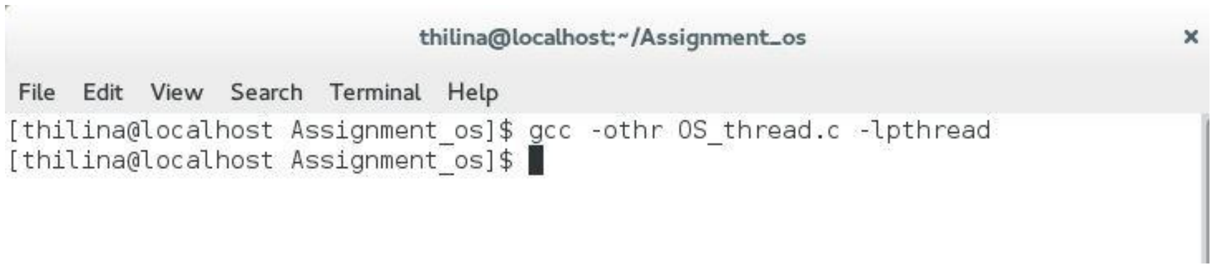
4.1.2 Process Execute + pass command args .


thilina@localhost:~/Assignment_os
File Edit View Search Terminal Help

```
Validation_Result_from_Process (3):5750
Row 3 is Valid

Validation_Result_from_Process (4):5751
Row 4 is Valid

Validation_Result_from_Process (5):5752
Row 5 is Valid

Validation_Result_from_Process (6):5753
Row 6 is Valid

Validation_Result_from_Process (7):5754
Row 7 is Valid

Validation_Result_from_Process (8):5755
Row 8 is Valid

Validation_Result_from_Process (9):5756
Row 9 is Valid

Validation_Result_from_Process (10):5757
Columns 9 of 9 Valid
[thilina@localhost Assignment_os]$
```

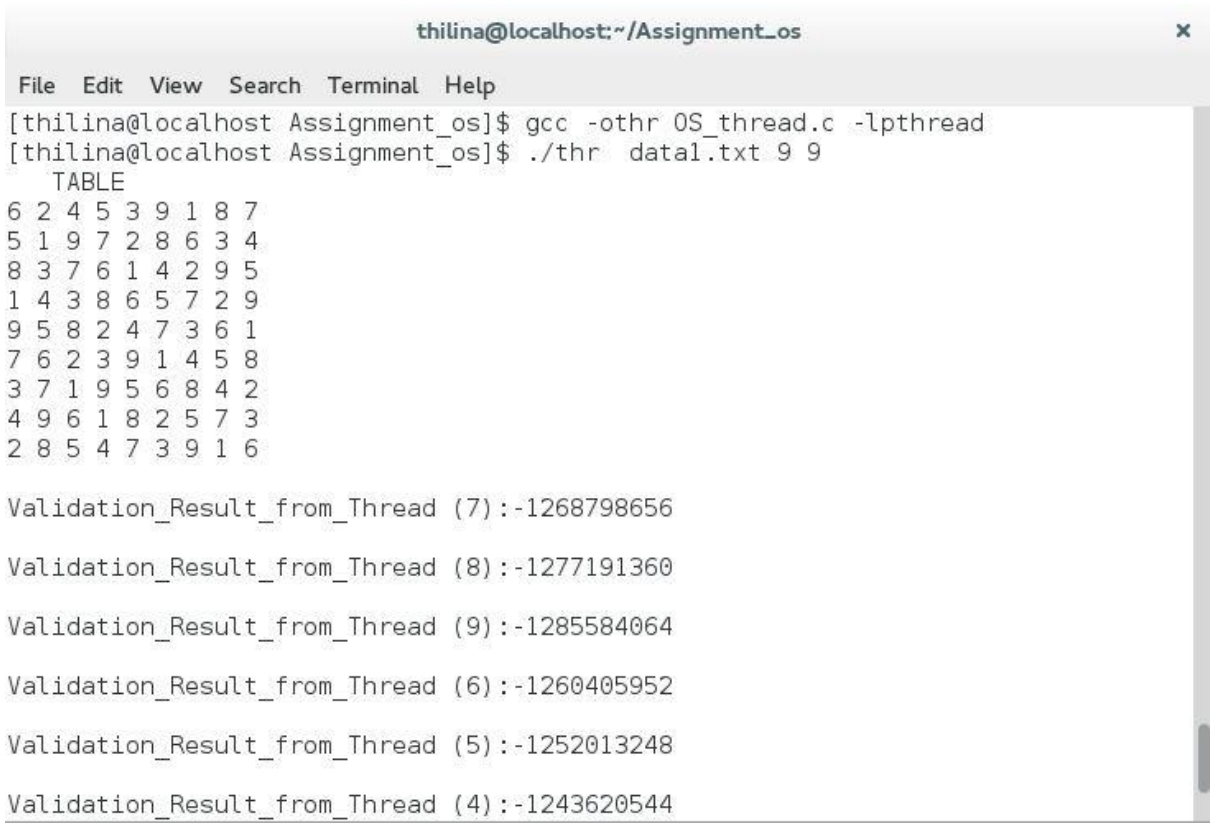
4.1.3 Process_Results

4.2 Threads


thilina@localhost:~/Assignment_os
File Edit View Search Terminal Help

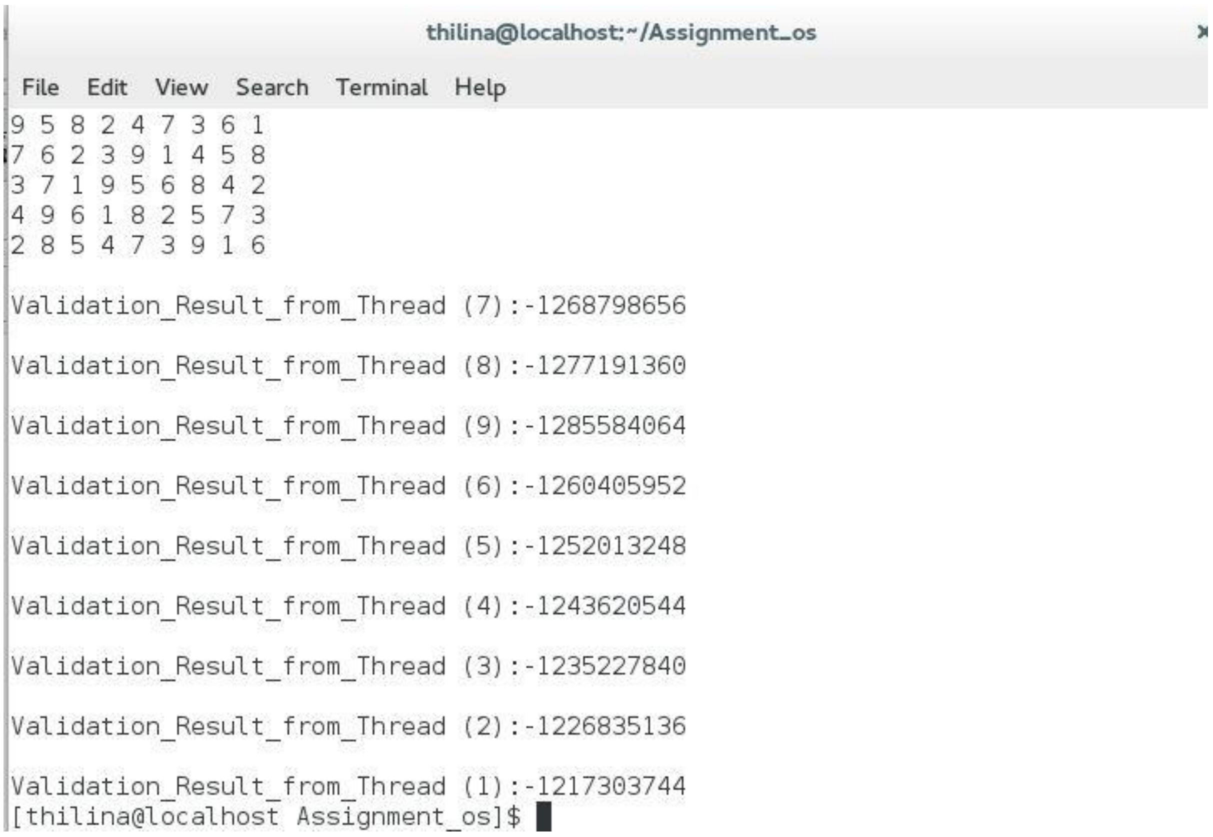
```
[thilina@localhost Assignment_os]$ gcc -othr OS_thread.c -lpthread
[thilina@localhost Assignment_os]$ 
```

4.2.1 Threads Compile


thilina@localhost:~/Assignment_os
File Edit View Search Terminal Help

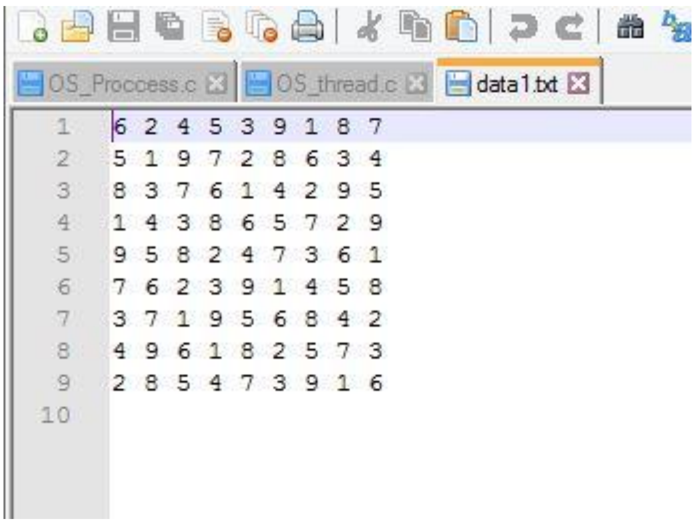
```
[thilina@localhost Assignment_os]$ gcc -othr OS_thread.c -lpthread
[thilina@localhost Assignment_os]$ ./thr  data1.txt 9 9
   TABLE
6 2 4 5 3 9 1 8 7
5 1 9 7 2 8 6 3 4
8 3 7 6 1 4 2 9 5
1 4 3 8 6 5 7 2 9
9 5 8 2 4 7 3 6 1
7 6 2 3 9 1 4 5 8
3 7 1 9 5 6 8 4 2
4 9 6 1 8 2 5 7 3
2 8 5 4 7 3 9 1 6

Validation_Result_from_Thread (7):-1268798656

Validation_Result_from_Thread (8):-1277191360

Validation_Result_from_Thread (9):-1285584064

Validation_Result_from_Thread (6):-1260405952

Validation_Result_from_Thread (5):-1252013248

Validation_Result_from_Thread (4):-1243620544
```

4.2.2 Excute+cmd arg


thilina@localhost:~/Assignment_os
File Edit View Search Terminal Help

```
9 5 8 2 4 7 3 6 1
7 6 2 3 9 1 4 5 8
3 7 1 9 5 6 8 4 2
4 9 6 1 8 2 5 7 3
2 8 5 4 7 3 9 1 6

Validation_Result_from_Thread (7):-1268798656

Validation_Result_from_Thread (8):-1277191360

Validation_Result_from_Thread (9):-1285584064

Validation_Result_from_Thread (6):-1260405952

Validation_Result_from_Thread (5):-1252013248

Validation_Result_from_Thread (4):-1243620544

Validation_Result_from_Thread (3):-1235227840

Validation_Result_from_Thread (2):-1226835136

Validation_Result_from_Thread (1):-1217303744
[thilina@localhost Assignment_os]$ 
```

4.2.3 Results



```
6 2 4 5 3 9 1 8 7
5 1 9 7 2 8 6 3 4
8 3 7 6 1 4 2 9 5
1 4 3 8 6 5 7 2 9
9 5 8 2 4 7 3 6 1
7 6 2 3 9 1 4 5 8
3 7 1 9 5 6 8 4 2
4 9 6 1 8 2 5 7 3
2 8 5 4 7 3 9 1 6
```

4.2.4 DATA INPUT.

5. **References**

1. http://www.unix.com/programming/172517-put-2d-array-shared-memory.html
2. Labsheets
3. http://stackoverflow.com/questions/29336955/sudoku-validator-in-c-using-threads-causing-segmentation-fault
4. http://stackoverflow.com/questions/41440365/2d-arrays-with-shared-memory
5. http://stackoverflow.com/questions/31188015/c-program-to-check-valid-sudoku