K213086 OS ASSIGNMENT 3

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#include <stdio.h>
#include <stdlib.h>
#include <pthread.h>
#include <unistd.h>

#define ROWS 10
#define COLS 10

int grid[ROWS][COLS]; // global grid of cells
pthread_mutex_t mutex = PTHREAD_MUTEX_INITIALIZER; // mutex for grid access
pthread_cond_t cond = PTHREAD_COND_INITIALIZER; // condition variable for synchronization

// helper function to print the grid
void print_grid() {
   for (int i = 0; i < ROWS; i++) {
      for (int j = 0; j < COLS; j++) {
         if (grid[i][j] == 0) printf("0");
         else printf("1");
      }
      printf("\n");
   }
   printf("\n");
}

// helper function to count the number of live neighbors for a given cell
int count_neighbors(int i, int j) {
```

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    int count = 0;
    for (int x = i-1; x <= i+1; x++) {
        for (int y = j-1; y <= j+1; y++) {
            if (x == i && y == j) continue;
            if (x < 0 || x >= ROWS || y < 0 || y >= COLS) continue;
            if (grid[x][y] == 1) count++;
        }
    }
    return count;
}

// thread function to update the grid for a range of rows
void* update_grid(void* args) {
    int start_row = *((int*)args); // start row for this thread
    int end_row = start_row + ROWS/2; // end row for this thread
    while (1) {
        // wait for the main thread to signal that it's safe to update the grid
        pthread_mutex_lock(&mutex);
        pthread_cond_wait(&cond, &mutex);
        pthread_mutex_unlock(&mutex);

        // update cells for this range of rows
        for (int i = start_row; i < end_row; i++) {
            for (int j = 0; j < COLS; j++) {
                int neighbors = count_neighbors(i, j);
                if (grid[i][j] == 1 && (neighbors < 2 || neighbors > 3)) {
                    grid[i][j] = 0;
                }
                else if (grid[i][j] == 0 && neighbors == 3) {
```

```
                grid[i][j] = 1;
            }
        }
    }
}

int main() {
    // initialize the grid with random values
    srand(time(NULL));
    for (int i = 0; i < ROWS; i++) {
        for (int j = 0; j < COLS; j++) {
            grid[i][j] = rand() % 2;
        }
    }

    // create four worker threads to update the grid
    pthread_t threads[2];
    int thread_args[2];
    for (int i = 0; i < 2; i++) {
        thread_args[i] = i * ROWS/2;
        pthread_create(&threads[i], NULL, update_grid, &thread_args[i]);
    }


        // main loop to print the grid and update it
        int iterations = 0;
        while (iterations < 20) { // exit loop after 100 iterations
            print_grid();
```

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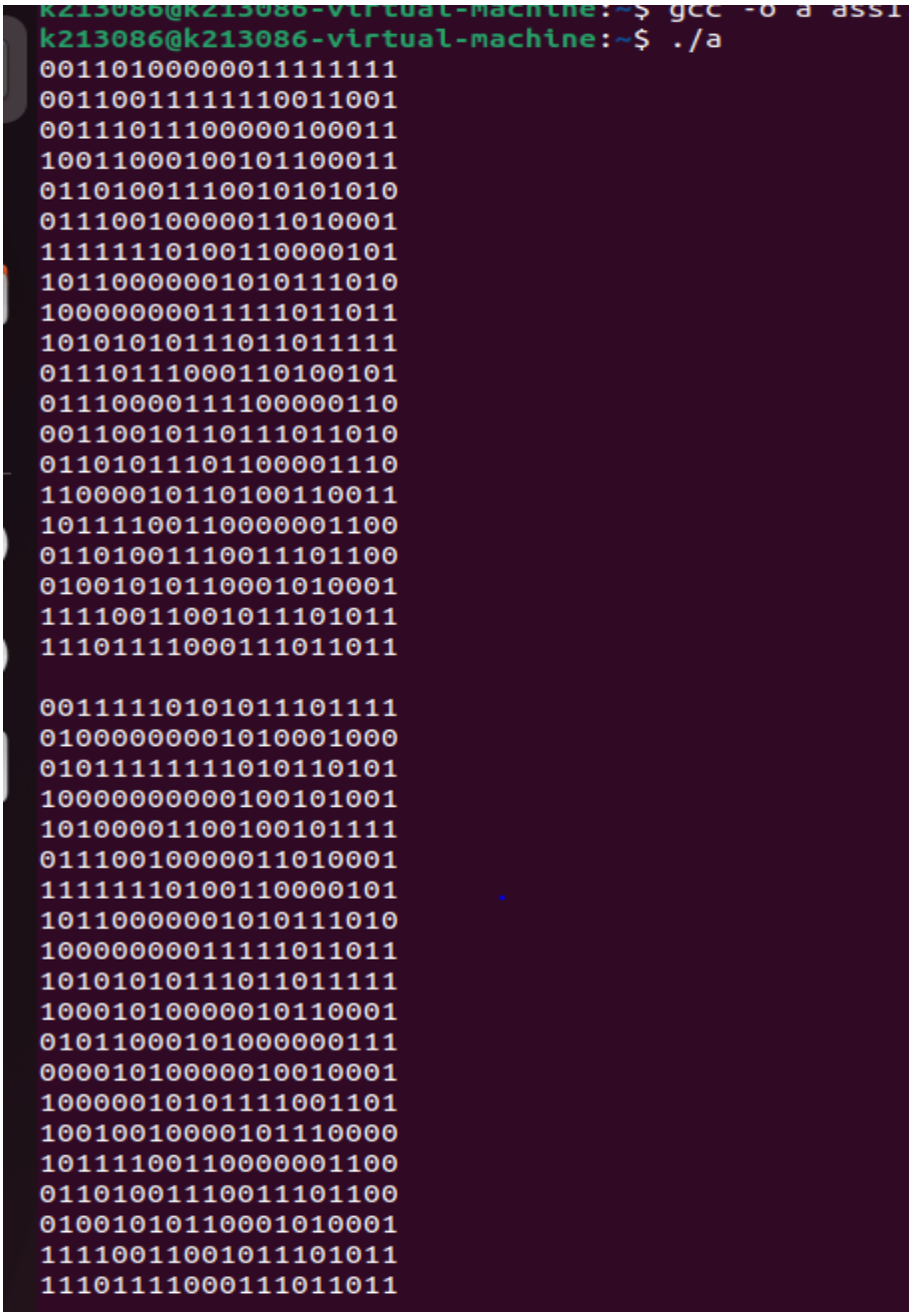
            // signal the worker threads to update the grid
            pthread_mutex_lock(&mutex);
            pthread_cond_broadcast(&cond);
            pthread_mutex_unlock(&mutex);

            usleep(100000); // sleep for 100ms
            iterations++;
        }

    return 0;
}
```



```
k213086@k213086-virtual-machine:~$ ./ass1.sh
Running with 1 processes

real    0m0.004s
user    0m0.004s
sys     0m0.001s
Running with 2 processes

real    0m0.004s
user    0m0.004s
sys     0m0.000s
k213086@k213086-virtual-machine:~$ gedit ass1.sh
```