PARALLEL AND DISTRIBUTED COMPUTING

LAB CAT

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COURSE CODE: CSE4001

SLOT: L35+L36

Question-2:

A search engine can be implemented using a farm of servers; each contains a subset of data that can be searched. Assume that this farm server has a single front-end that interacts with clients who submit queries. Implement the above server form using master-worker pattern.

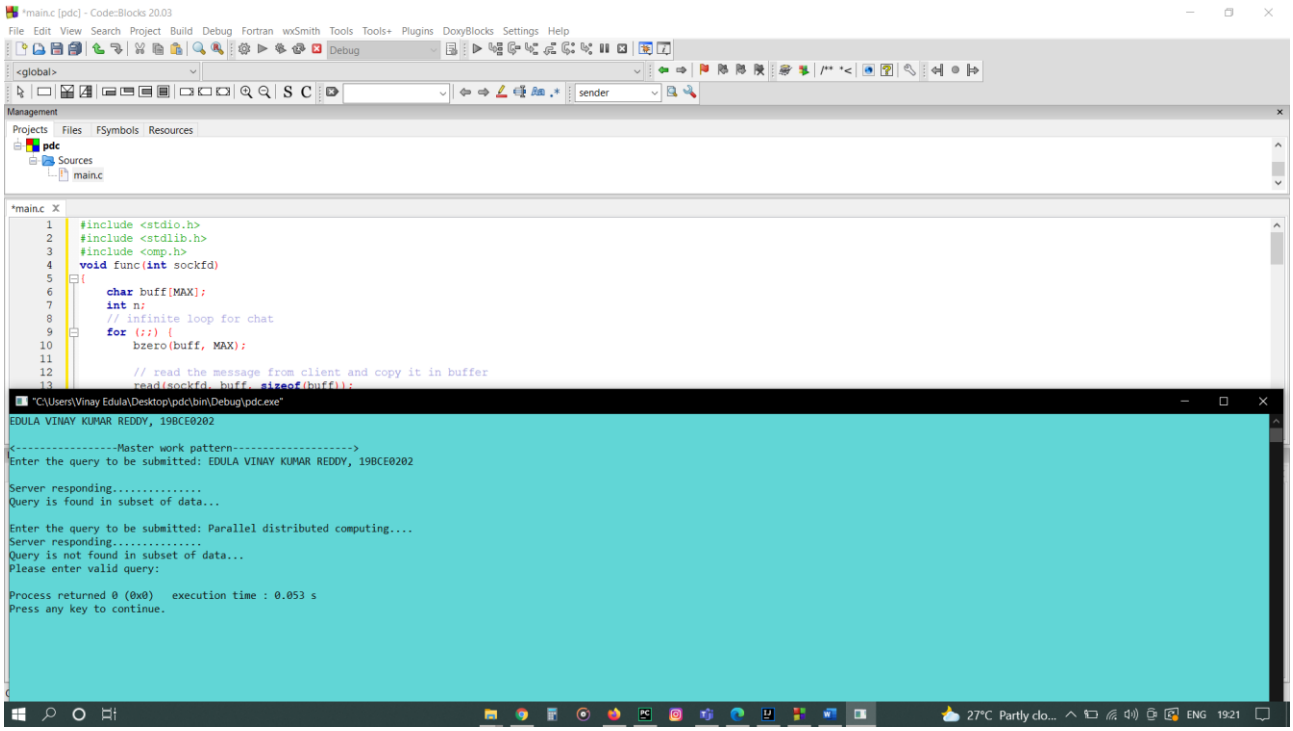
Open MP program for Master-work pattern:

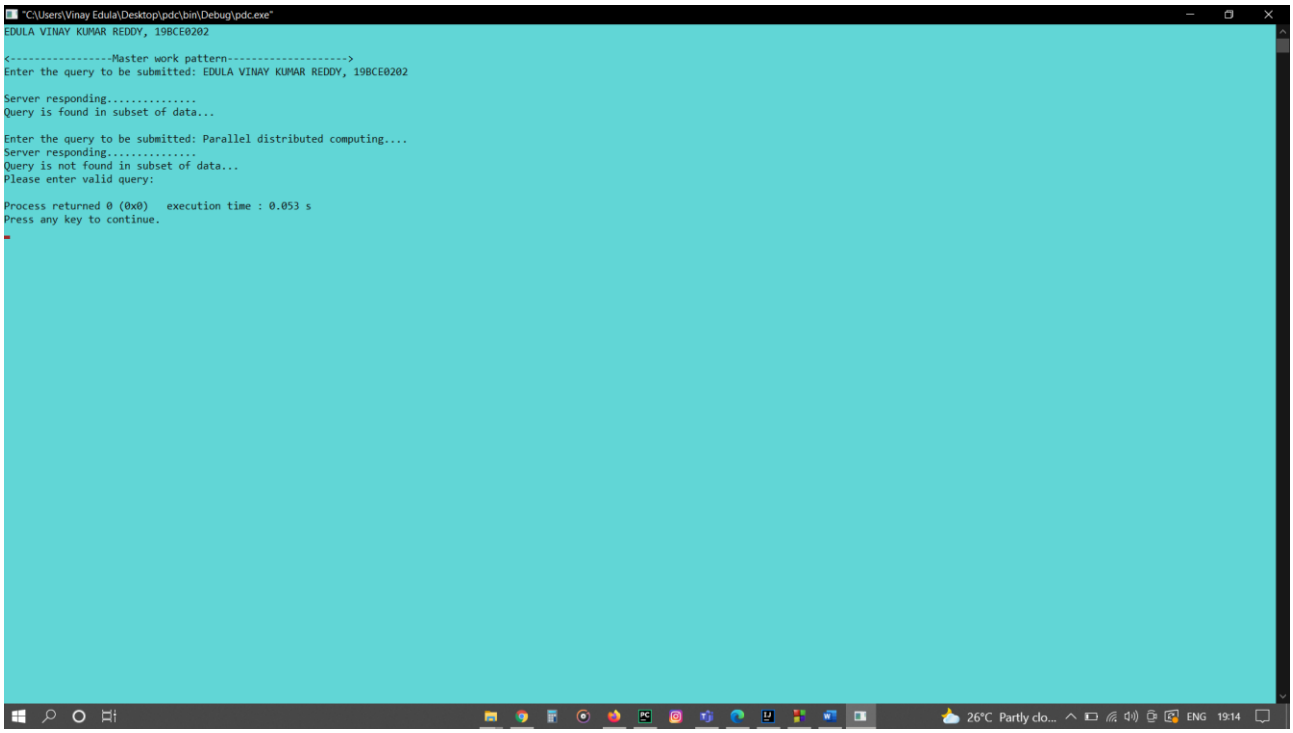
```
#include <stdio.h>
#include <stdlib.h>
#include <omp.h>
void func(int sockfd)
{
   char buff[MAX];
   int n;
   // infinite loop for chat
   for (;;) {
      bzero(buff, MAX);

      // read the message from client and copy it in buffer
      read(sockfd, buff, sizeof(buff));
      // print buffer which contains the client contents
      printf("From client: %s\t To client : ", buff);
      bzero(buff, MAX);
      n = 0;
      // copy server message in the buffer
      while ((buff[n++] = getchar()) != '\n')
         ;

      write(sockfd, buff, sizeof(buff));

      if (strncmp("exit", buff, 4) == 0) {
         printf("Server Exit...\n");
         break;
      }
```

```
    }
}

// Driver function
int main()
{
    int sockfd, connfd, len;
    struct sockaddr_in servaddr, cli;

    // socket create and verification
    sockfd = socket(AF_INET, SOCK_STREAM, 0);
    if (sockfd == -1) {
        printf("socket creation failed...\n");
        exit(0);
    }
    else
        printf("Socket successfully created..\n");
    bzero(&servaddr, sizeof(servaddr));

    // assign IP, PORT
    servaddr.sin_family = AF_INET;
    servaddr.sin_addr.s_addr = htonl(INADDR_ANY);
    servaddr.sin_port = htons(PORT);

    // Binding newly created socket to given IP and verification
    if ((bind(sockfd, (SA*)&servaddr, sizeof(servaddr))) != 0) {
        printf("socket bind failed...\n");
        exit(0);
    }
    else
        printf("Socket successfully binded..\n");


    if ((listen(sockfd, 5)) != 0) {
        printf("Listen failed...\n");
        exit(0);
    }
    else
        printf("Server listening..\n");
    len = sizeof(cli);

    connfd = accept(sockfd, (SA*)&cli, &len);
    if (connfd < 0) {
        printf("server accept failed...\n");
        exit(0);
    }
    else
        printf("server accept the client...\n");
```

```
    // Function for chatting between client and server
    func(connfd);

    // After chatting close the socket
    close(sockfd);
}
```

Output:





Use OpenMP to implement a producer-consumer program in which some of the threads are producers and others are consumers. The producers read text from a collection of files, one per producer. They insert lines of text into a single shared queue. The consumers take the lines of text and tokenize them. Tokens are "words" separated by white space. When a consumer finds a token, it writes it to `stdout`.

OpenMP Program

```
#include <stdio.h>
#include <stdlib.h>
#include <omp.h>
int main(int argc, char* argv[]) {
int prod_count, cons_count;
FILE* files[MAX_FILES];
int file_count;
if (argc != 3) Usage(argv[0]);
prod_count = strtol(argv[1], NULL, 10);
cons_count = strtol(argv[2], NULL, 10);
Get_files(files, &file_count);
# ifdef DEBUG
printf("prod_count = %d, cons_count = %d, file_count = %d\n", prod_count, cons_count, file_count);
# endif
Prod_cons(prod_count, cons_count, files, file_count);
return 0;
}
void Prod_cons(int prod_count, int cons_count, FILE* files[], int file_count) {
int thread_count = prod_count + cons_count;
struct list_node_s* queue_head = NULL; struct list_node_s* queue_tail = NULL;
int prod_done_count = 0;
# pragma omp parallel num_threads(thread_count) default(none) \
shared(file_count, queue_head, queue_tail, files, prod_count, \
cons_count, prod_done_count)
{ int my_rank = omp_get_thread_num(), f;
if (my_rank < prod_count) {
for (f = my_rank; f < file_count; f += prod_count) {
Read_file(files[f], &queue_head, &queue_tail, my_rank);
}
# pragma omp atomic
prod_done_count++;
} else {
struct list_node_s* tmp_node;
while (prod_done_count < prod_count) {
tmp_node = Dequeue(&queue_head, &queue_tail, my_rank);
if (tmp_node != NULL) {
Tokenize(tmp_node->data, my_rank);
free(tmp_node); } }
while (queue_head != NULL) {
tmp_node = Dequeue(&queue_head, &queue_tail, my_rank);
if (tmp_node != NULL) {
Tokenize(tmp_node->data, my_rank);
free(tmp_node); } } }
}
}
```

```
void Read_file(FILE* file, struct list_node_s** queue_head,
struct list_node_s** queue_tail, int my_rank) {
while (fgets(line, MAX_CHAR, file) != NULL) {
printf("Th %d > read line: %s", my_rank, line);
Enqueue(line, queue_head, queue_tail);
line = malloc(MAX_CHAR*sizeof(char));
}
fclose(file);
}
# pragma omp critical
if (*queue_tail == NULL) {
*queue_head = tmp_node;
*queue_tail = tmp_node;
} else {
(*queue_tail)->next = tmp_node;
*queue_tail = tmp_node;
}
}
struct list_node_s* Dequeue(struct list_node_s** queue_head,
struct list_node_s** queue_tail, int my_rank) {
struct list_node_s* tmp_node = NULL;
if (*queue_head == NULL)
return NULL;
# pragma omp critical
{
if (*queue_head == *queue_tail)
*queue_tail = (*queue_tail)->next;
tmp_node = *queue_head;
*queue_head = (*queue_head)->next;
}
return tmp_node;
}
```

Output: