CD LAB WEEK7
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Q1.

CODE :
getNextToken.c

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <stdbool.h>
#include <ctype.h>
#include <errno.h>


#define SZ 20

struct token{
  char toktype[SZ];
  char name[SZ];
  int row,col,idx;
  int sz;
};

struct ListElement{
  struct token tok;
  struct ListElement *next;
};

struct ListElement *TABLE[SZ];
int row=1,col=1,val=-1,TableLength = 0;
char prev[SZ];
bool filenotended=true;

char keyword[34][10]={"printf","scanf","auto","double","int",
"struct","break","else","long","switch","case","enum","register",
"typedef","char","extern","return","union","continue",
"for","signed","void","do","if","static","while","default","goto",
"sizeof","volatile","const","float","short","unsigned"};


bool iskeyword(char* buf){
  for(int i=0;i<34;i++){
            if(strcmp(keyword[i],buf)==0)
                return true;
  }
  return false;
}

bool isDelimiter(char ch){
    if (ch == ',' || ch == ';'  || ch == '(' || ch == ')' || ch == '[' || ch == ']' || ch == '{' || ch == '}')
          return true;
          return false;
}

bool isArithmetic_operator(char ch)
{
          if (ch == '%' || ch == '+' || ch == '-' || ch == '*' ||
          ch == '/' )
          return true;
          return false;
}

void printtok(struct token t){
  printf("<%s,%d,%d> ",t.name,t.row,t.col-1);
}

int SEARCH(struct token tk){
          //printf("s\n");
          struct ListElement * cur;
          for(int i=0;i<=val;i++){
          cur = TABLE[i];
          if(cur&&strcmp(tk.toktype,"func")==0){
          if(strcmp((cur->tok).name,tk.name)==0){
          return 1;
          }
          }
          else{
          while(cur){

if(strcmp((cur->tok).name,tk.name)==0&&strcmp((cur->tok).toktype,tk.toktype)==0&&(cur->tok).i
dx==tk.idx){
          return 1;
          }
          cur=cur->next;
          }
```

```
            }
    }
            return 0;
}

void INSERT(struct token tk){
  if(strcmp(tk.toktype,"func")!=0&&SEARCH(tk)==1){
            return;
   }

  struct ListElement* cur = malloc(sizeof(struct ListElement));
  cur->tok = tk;
  cur->next = NULL;

  if(TABLE[val]==NULL){
            TABLE[val] = cur; // No collosion.
  }
  else{
            struct ListElement * ele= TABLE[val];
            while(ele->next!=NULL){
            ele = ele->next; // Add the element at the End in the case of a collision.
            }
            ele->next = cur;
  }
}

struct token getnextToken(FILE *fa){
            char ca,cb;
            int i,j;
            char buf[SZ],temp[SZ];
            struct token s;
            ca=fgetc(fa);
            while(ca!=EOF){
             //newline
             if(ca=='\n'){
                        row++;
                        col=1;
                        //printf("\n");
             }
             //blank space and tabs
             else if(ca==' '||ca=='\t'){
                          col++;//doubt
            while(ca==' '||ca=='\t')
                        ca=fgetc(fa);
```

```
fseek(fa,-1,SEEK_CUR);
 }
//comments
else if(ca=='/'){
col++;
             cb=fgetc(fa);
             if(cb=='/'){
            while(ca!='\n')
            ca=fgetc(fa);
            fseek(fa,-1,SEEK_CUR);
             }
             else if(cb=='*'){
            do{
                         while(ca!='*')
                                     ca = fgetc(fa);
                         ca = fgetc(fa);
            }while(ca!='/');
             }
             else{
                         i=0;
            while(ca!='\n'){
             temp[i++] = ca;
             ca = fgetc(fa);
            }
            temp[i]='\0';
            strcpy(s.name,"syntax error");
            s.row=row;
            s.col=col;
            fseek(fa,-1,SEEK_CUR);
            return s;
             }
}
//preprocessor
else if(ca=='#'){
             i=0;
while(ca!='\n'){
              temp[i++]=ca;
              ca=fgetc(fa);
}
temp[i]='\0';
fseek(fa,-1,SEEK_CUR);
if(strstr(temp,"#include")==NULL && strstr(temp,"#define")==NULL){//not working
            printf("include\n");
              strcpy(s.name,"syntax error");
            s.row=row;
            row++;
            s.col=col;
            return s;
}
}
//keywords and identifiers
else if(isalpha(ca)||ca=='_'){
             i=0;
             while(isalnum(ca)||ca=='_'){
buf[i++]=ca;
ca=fgetc(fa);
col++;
             }
             buf[i]='\0';
             fseek(fa,-1,SEEK_CUR);

             if(iskeyword(buf)){
            strcpy(s.name,buf);
            strcpy(prev,buf);
            s.row=row;
            s.col=col-strlen(buf)+1;
            return s;
             }
             else{
            if(ca=='('){
            strcpy(s.name,buf);
            strcpy(s.toktype,"func");
            s.sz=-1;
            if(SEARCH(s)==0){
                        val++;
            }
            s.idx = val;
            INSERT(s);
            return s;
            }
            char w[10]="";
            strcat(w,"id ");
            strcat(w,buf);
            strcpy(s.name,w);
            strcpy(s.toktype,prev);
            s.row=row;
            s.col=col-strlen(buf)+1;
```

```
                    if(strcmp(prev,"int")==0)
                    s.sz=sizeof(int);
                    else if(strcmp(prev,"char")==0)
                    s.sz=sizeof(char);
                    else if(strcmp(prev,"bool")==0)
                    s.sz=sizeof(bool);
                    else
                    s.sz=0;

if(strcmp(prev,"return")==0||strcmp(prev,"if")==0||strcmp(prev,"scanf")==0||strcmp(prev,"printf")=
=0||strcmp(prev,"for")==0)
                    return s;
                    s.idx=val;
                    INSERT(s);

                    return s;
                     }
          }
          //relational operator
          else if(ca=='='||ca=='>'||ca=='<'||ca=='!'){
                     cb=fgetc(fa);
                     i=0;
                     temp[i++]=ca;
          col++;
                     if(cb=='='){
                    temp[i++] = cb;
                    temp[i] = '\0';
                    strcpy(s.name,temp);
                    s.row=row;
                    s.col=col;
                    col++;
                    return s;
                     }
                     else{
                    temp[i]='\0';
                    strcpy(s.name,temp);
                               s.row=row;
                               s.col=col;
                    fseek(fa,-1,SEEK_CUR);
                               return s;
                     }

          }
          //string
```

```
else if(ca=='"'){
         i=0;
do{
        col++;
        i++;
        ca=fgetc(fa);
}while(ca!='"');
col++;
strcpy(s.name,"string literal");
                s.row=row;
                s.col=col-i;
                return s;
}
//delimiters
else if(isDelimiter(ca)){
         i=0;
         temp[i++]=ca;
         temp[i]='\0';
         col++;
strcpy(s.name,temp);
                s.row=row;
                s.col=col;
                return s;
}
//numeric constants
else if(isdigit(ca)){
        i=0;
        while(isdigit(ca)){
                col++;
                i++;
                ca=fgetc(fa);
        }
        fseek(fa,-1,SEEK_CUR);
        strcpy(s.name,"num");
                s.row=row;
                s.col=col-i+1;
                return s;
}
//arithmetic op
else if(isArithmetic_operator(ca)){
         i=0;
         temp[i++]=ca;
         temp[i]='\0';
         col++;
```

```
            strcpy(s.name,temp);
                                s.row=row;
                                s.col=col;
                                return s;
            }
            ca=fgetc(fa);
            }
            strcpy(s.name,"end");
            return s;
}

void Initialize(){
  for(int i=0;i<SZ;i++){
            TABLE[i] = NULL;
  }
}

void Display(){
//iterate through the linked list and display
 for(int i=0;i<=val;i++){
            struct ListElement * cur = TABLE[i];
            printf("%d %s %s\n\n",i+1,(cur->tok).name,(cur->tok).toktype);
            cur=cur->next;
            while(cur){
            printf("%s   %s   %d\n",(cur->tok).name, (cur->tok).toktype,(cur->tok).sz);
            cur=cur->next;
            }
            printf("[STATUS] Done.\n");
 }
}
```

parser.c
Code :

```
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include "getNextToken.c"


//prototypes
void declarations();
void assign_stat();
void assign_stat_prime();
void data_type();
void identifier_list();
void identifier_list_prime();
void untoken();
struct token s;

FILE *fa;

void untoken(){
    int len;
            if(s.name[0]=='i'&&s.name[1]=='d'&&s.name[2]==' ')
            len=strlen(s.name)-3;
            else len=strlen(s.name);
            fseek(fa,-1*len,SEEK_CUR);
}

void Program(){
             s=getnextToken(fa);
             if(strcmp(s.name,"main")==0){
            s=getnextToken(fa);
            if(strcmp(s.name,"(")==0){
                        s=getnextToken(fa);
                        if(strcmp(s.name,")")==0){
                        s=getnextToken(fa);
                        if(strcmp(s.name,"{")==0){
                                    declarations();
                                    assign_stat();
                                    s=getnextToken(fa);
                                    if(strcmp(s.name,"}")==0){
                                                return;
                                    }
                                    else{
                                                 printf("[ERROR] : missing '}' row : %d col :%d\n",s.row,s.col);
                                                 exit(1);
                                    }
                        }
                        else{
                                                 printf("[ERROR] : missing '{' row : %d col :%d\n",s.row,s.col);
                                                 exit(1);
                        }
                        }
                        else{
                        printf("[ERROR]: missing ')' row : %d col :%d\n",s.row,s.col);
                        exit(1);
```

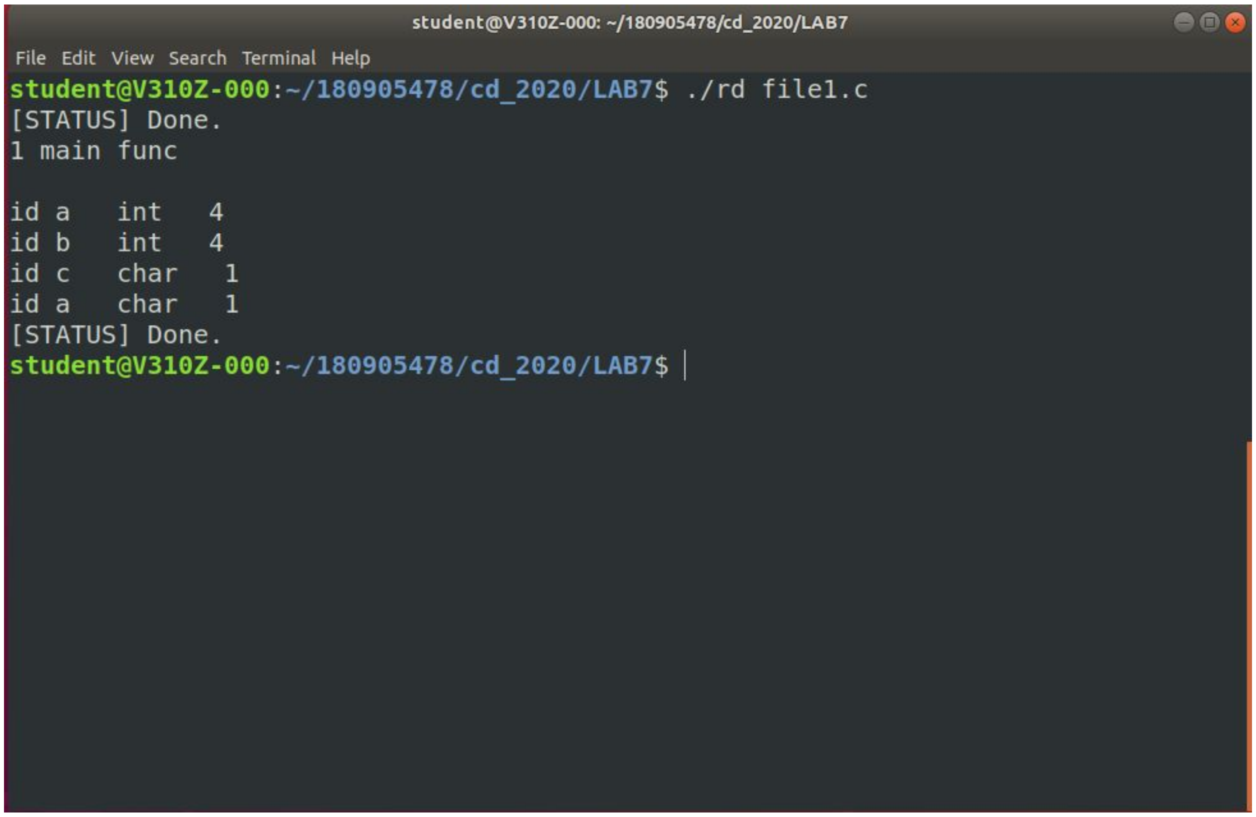
```
                }
          }
          else{
                printf("[ERROR]: missing '(' row : %d col :%d\n",s.row,s.col);
                exit(1);
          }
           }
           else{
                printf("[ERROR]: missing main row : %d col :%d\n",s.row,s.col);
                exit(1);
           }

}

void declarations(){

   s=getnextToken(fa);
   //printf("dec %s\n",s.name);
   if(strcmp(s.name,"int")==0||strcmp(s.name,"char")==0){
                identifier_list();
          s=getnextToken(fa);
          if(strcmp(s.name,";")==0){
                declarations();
          }
          else{
                printf("[ERROR]: expected ';' row : %d col :%d\n",s.row,s.col);
                exit(1);
          }
   }
          else{
           untoken();
          }
}

void identifier_list(){

          s=getnextToken(fa);
          //printf("id %s\n",s.name);
          if(s.name[0]=='i'&&s.name[1]=='d'&&s.name[2]==' '){
          identifier_list_prime();
          }
          else{
                printf("[ERROR] : expected identifier row : %d col :%d\n",s.row,s.col);
                exit(1);
```

```
        }

}

void identifier_list_prime(){

        s=getnextToken(fa);
        //printf("idprime %s\n",s.name);
        if(strcmp(s.name,",")==0){
        identifier_list();
        }
        else{
        if(strcmp(s.name,";")==0){
                untoken();
        }
        else{
                printf("[ERROR] : missing ',' row : %d col : %d\n",s.row,s.col);
                exit(1);
        }
        }
                //printf("error : expecting ',' in line %d\n",s.row);


}

void assign_stat(){
        s=getnextToken(fa);
        // printf("as %s\n",s.name);
        if(s.name[0]=='i'&&s.name[1]=='d'&&s.name[2]==' '){
        s=getnextToken(fa);
        if(strcmp(s.name,"=")==0)
                        assign_stat_prime();
                else{
                         printf("[ERROR] : missing '=' row : %d col :%d\n",s.row,s.col);
                        exit(1);
                }
        }
        else{
                printf("[ERROR] : missing identifier row : %d col :%d\n",s.row,s.col);
        exit(1);
        }

}
```

```
void assign_stat_prime(){

            s=getnextToken(fa);
            // printf("aspp %s\n",s.name);
            if((s.name[0]=='i'&&s.name[1]=='d'&&s.name[2]==' ')||strcmp(s.name,"num")==0){
            s=getnextToken(fa);
            if(strcmp(s.name,";")==0)
                                    return;
                        else{
                                     printf("[ERROR] : missing ';' row : %d col :%d\n",s.row,s.col);
                                    exit(1);
                        }
            }
            else{
                        printf("[ERROR] : missing identifier or numeric constant row : %d col
:%d\n",s.row,s.col);
            exit(1);
            }
}

void data_type(){
    s=getnextToken(fa);
    if(strcmp(s.name,"int")==0||strcmp(s.name,"char")==0)
             return;
    else{
             printf("[ERROR] : data type not available row : %d col :%d\n",s.row,s.col);
            exit(1);
    }
}

int main(int argc, char const *argv[])
{
  if(argc!=2){
            printf("[ERROR] Usage : %s <filename>",argv[0]);
            exit(1);
  }
    fa=fopen(argv[1],"r");
    if(fa==NULL){
             printf("[ERROR] Could not open file for reading.");
            exit(1);
    }
    Initialize();
    Program();
    s=getnextToken(fa);
    if(strcmp(s.name,"end")==0)
     printf("[STATUS] Successfully parsed.\n");
    Display();


    return 0;
}
```

Input file :

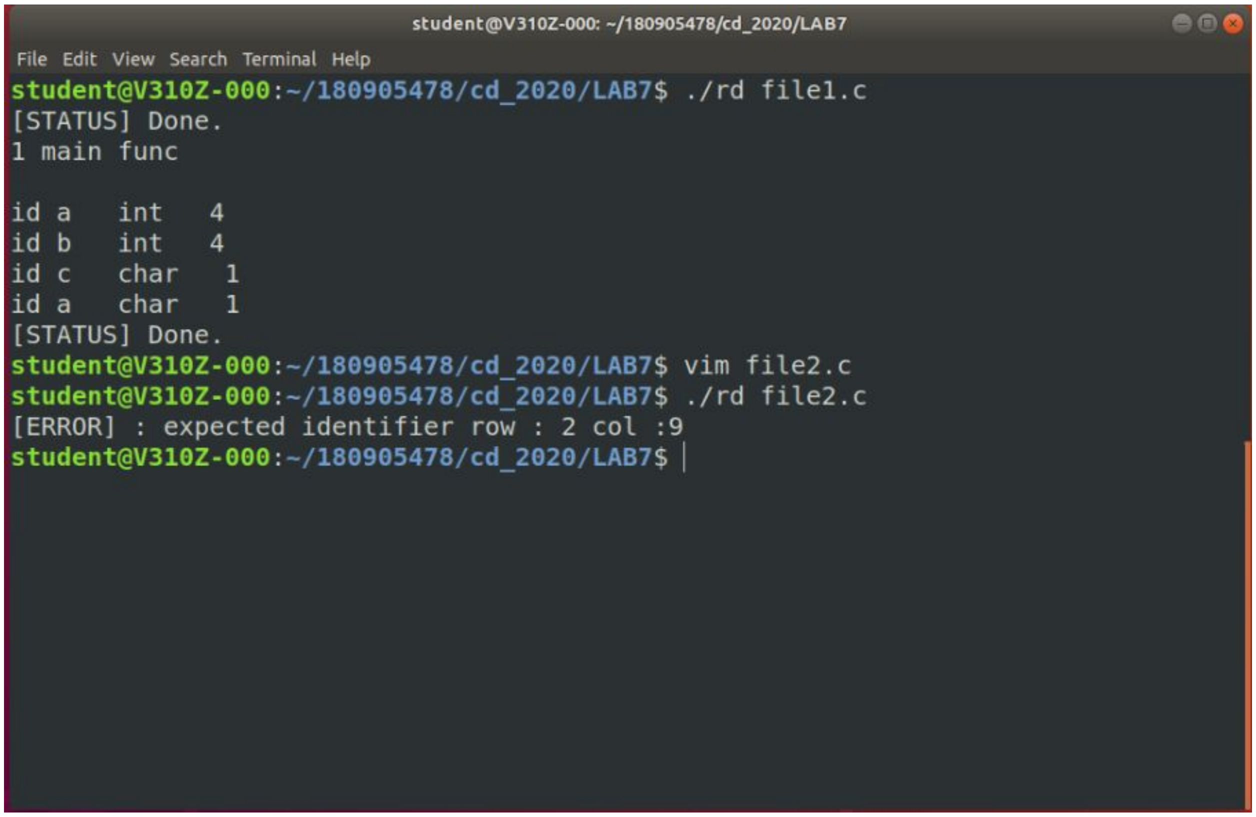
1. main(){
   int a,b ;
   char c;
   a=25;
   }



```
student@V310Z-000:~/180905478/cd_2020/LAB7$ ./rd file1.c
[STATUS] Done.
1 main func

id a   int   4
id b   int   4
id c   char   1
id a   char   1
[STATUS] Done.
student@V310Z-000:~/180905478/cd_2020/LAB7$
```

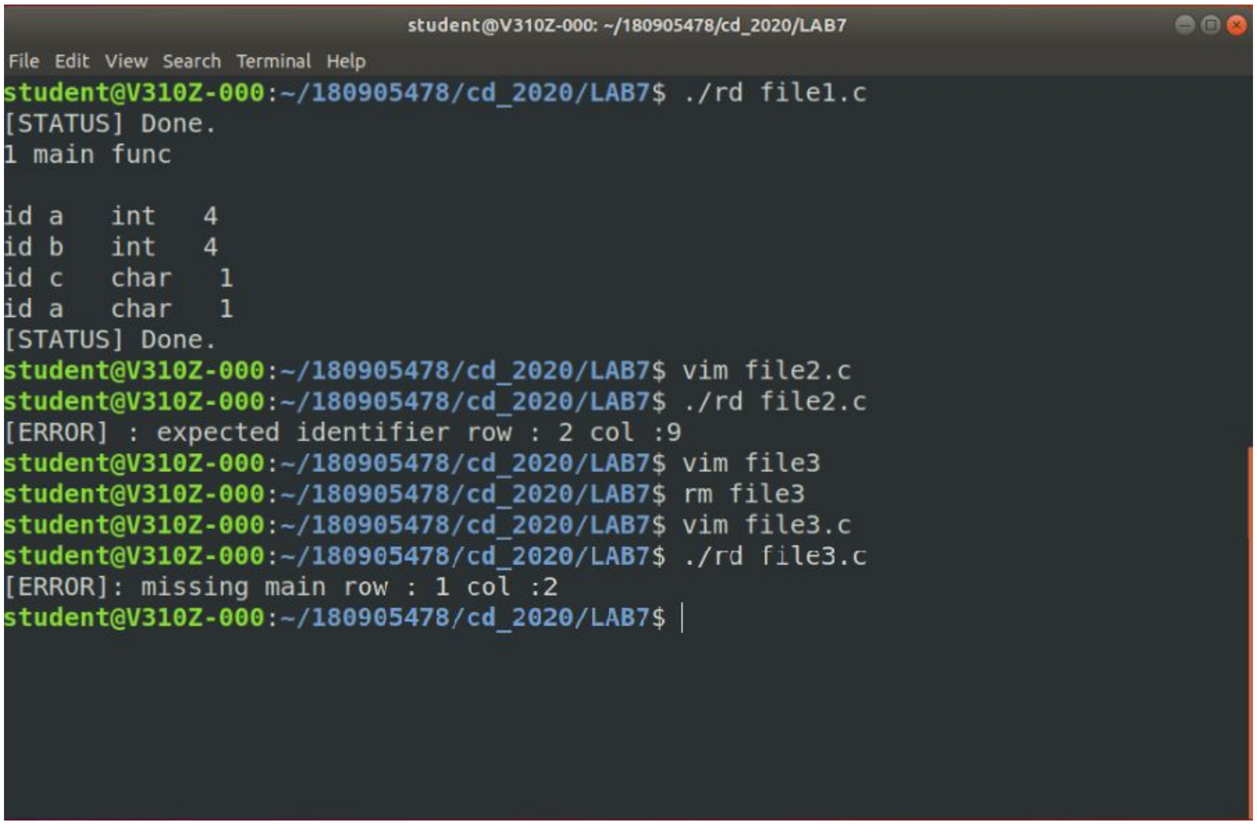
2. main(){
   int a ,,b;
   char c ;
   a=24;

   }



```
student@V310Z-000:~/180905478/cd_2020/LAB7$ ./rd file1.c
[STATUS] Done.
1 main func

id a    int    4
id b    int    4
id c    char    1
id a    char    1
[STATUS] Done.
student@V310Z-000:~/180905478/cd_2020/LAB7$ vim file2.c
student@V310Z-000:~/180905478/cd_2020/LAB7$ ./rd file2.c
[ERROR] : expected identifier row : 2 col :9
student@V310Z-000:~/180905478/cd_2020/LAB7$
```

3.int a b ;



```
student@V310Z-000:~/180905478/cd_2020/LAB7$ ./rd file1.c
[STATUS] Done.
1 main func

id a    int    4
id b    int    4
id c    char    1
id a    char    1
[STATUS] Done.
student@V310Z-000:~/180905478/cd_2020/LAB7$ vim file2.c
student@V310Z-000:~/180905478/cd_2020/LAB7$ ./rd file2.c
[ERROR] : expected identifier row : 2 col :9
student@V310Z-000:~/180905478/cd_2020/LAB7$ vim file3
student@V310Z-000:~/180905478/cd_2020/LAB7$ rm file3
student@V310Z-000:~/180905478/cd_2020/LAB7$ vim file3.c
student@V310Z-000:~/180905478/cd_2020/LAB7$ ./rd file3.c
[ERROR]: missing main row : 1 col :2
student@V310Z-000:~/180905478/cd_2020/LAB7$
```