CD LAB -WEEK 8

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Section :B

Q1.

Lex.c

```
#include <stdio.h>
#include <stdlib.h>
#include <ctype.h>
#include <string.h>
const char *keywords[] = {

    "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",

    "printf",

    "scanf",
    "true",
    "false",
    "bool"

};
const char *datypes[] = {"int", "char", "void", "float", "bool", "double"};
int isdtype(char *w)
{
    int i;
    for (i = 0; i < sizeof(datypes) / sizeof(char*); i++)
    {
        if (strcmp(w, datypes[i]) == 0)
        {
            return 1;
        }
    }
    return 0;
}
int isKeyword(char *w)
{

    int i;

    for (i = 0; i < sizeof(keywords) / sizeof(char*); i++)

    {

        if (strcmp(w, keywords[i]) == 0)
```

```
        {
                return 1;
        }
    }
    return 0;
}
struct token
{
    char lexeme[128];
    unsigned int row, col;
    char type[64];
};
struct sttable
{
    int sno;
    char lexeme[128];
    char dtype[64];
    char type[64];
    int size;
};
int findTable(struct sttable *tab, char *nam, int n)
{
    int i = 0;
    for (i = 0; i < n; i++)
    {
        if (strcmp(tab[i].lexeme, nam) == 0)
        {
                return 1;
        }
    }
    return 0;
}
```

```
struct sttable fillTable(int sno, char *lexn, char *dt, char *t, int s)
{
    struct sttable tab;
    tab.sno = sno;
    strcpy(tab.lexeme, lexn);
    strcpy(tab.dtype, dt);
    strcpy(tab.type, t);
    tab.size = s;
    return tab;
}
void printTable(struct sttable *tab, int n)
{
    for (int i = 0; i < n; i++)
    {
        printf("%d %s %s %s %d\n", tab[i].sno, tab[i].lexeme, tab[i].dtype,
tab[i].type, tab[i].size);
    }
}
static int row = 1, col = 1;
char buf[2048];
char dbuf[128];
int ind = 0;
const char specialsymbols[] = {'?', ';', ':', ','};
const char arithmeticsymbols[] = {'*'};
int charIs(int c, const char *arr)
{
    int len;
    if (arr == specialsymbols)
    {
        len = sizeof(specialsymbols) / sizeof(char);
    }
    else if (arr == arithmeticsymbols)
    {
        len = sizeof(arithmeticsymbols) / sizeof(char);
    }
    for (int i = 0; i < len; i++)
    {
```

```
        if (c == arr[i])
        {
                return 1;
        }
    }
    return 0;
}
void fillToken(struct token *tkn, char c, int row, int col, char *type)
{
    tkn->row = row;
    tkn->col = col;
    strcpy(tkn->type, type);
    tkn->lexeme[0] = c;
    tkn->lexeme[1] = '\0';
}
void newLine()
{
    ++row;
    col = 1;
}
int sz(char *w)
{
    if (strcmp(w, "int") == 0)
        return 4;
    if (strcmp(w, "char") == 0)
        return 1;
    if (strcmp(w, "void") == 0)
        return 0;
    if (strcmp(w, "float") == 0)
        return 8;
    if (strcmp(w, "bool") == 0)
        return 1;
}
struct token getNextToken(FILE *fa)
{
    int c;
    struct token tkn =
```

```
{
	.row = -1
};
int gotToken = 0;
while (!gotToken && (c = fgetc(fa)) != EOF)
{
	if (charIs(c, specialsymbols))
	{
		fillToken(&tkn, c, row, col, "SS");
		gotToken = 1;
		++col;
	}
	else if (charIs(c, arithmeticsymbols))
	{
		fseek(fa, -1, SEEK_CUR);
		c = getc(fa);
		if (isalnum(c)) {
			fillToken(&tkn, c, row, col, "ARITHMETICOPERATOR");
			gotToken = 1;
			++col;
		}
		fseek(fa, 1, SEEK_CUR);
	}
	else if (c == '(')
	{
		fillToken(&tkn, c, row, col, "LB");
		gotToken = 1;
		col++;
	}
	else if (c == ')')
	{
		fillToken(&tkn, c, row, col, "RB");
		gotToken = 1;
		col++;
	}
	else if (c == '{')
	{
```

```
        fillToken(&tkn, c, row, col, "LC");
        gotToken = 1;
        col++;
}
else if (c == '}')
{
        fillToken(&tkn, c, row, col, "RC");
        gotToken = 1;
        col++;
}
else if (c == '[')
{
        fillToken(&tkn, c, row, col, "LS");
        gotToken = 1;
        col++;
}
else if (c == ']')
{
        fillToken(&tkn, c, row, col, "RS");
        gotToken = 1;
        col++;
}
else if (c == '+')
{
        int x = fgetc(fa);
        if (x != '+')
        {
                fillToken(&tkn, c, row, col, "ARITHMETICOPERATOR");
                gotToken = 1;
                col++;
                fseek(fa, -1, SEEK_CUR);
        }
        else
        {
                fillToken(&tkn, c, row, col, "UNARYOPERATOR");
                strcpy(tkn.lexeme, "++");
                gotToken = 1;
```

```
                col += 2;
        }
}
else if (c == '-')
{
        int x = fgetc(fa);
        if (x != '-')
        {
                fillToken(&tkn, c, row, col, "ARITHMETICOPERATOR");
                gotToken = 1;
                col++;
                fseek(fa, -1, SEEK_CUR);
        }
        else
        {
                fillToken(&tkn, c, row, col, "UNARYOPERATOR");
                strcpy(tkn.lexeme, "++");
                gotToken = 1;
                col += 2;
        }
}
else if (c == '=')
{
        int x = fgetc(fa);
        if (x != '=')
        {
                fillToken(&tkn, c, row, col, "ASSIGNMENTOPERATOR");
                gotToken = 1;
                col++;
                fseek(fa, -1, SEEK_CUR);
        }
        else
        {
                fillToken(&tkn, c, row, col, "RELATIONALOPERATOR");
                strcpy(tkn.lexeme, "++");
                gotToken = 1;
                col += 2;
```

```
        }
}
else if (isdigit(c))
{
        fillToken(&tkn, c, row, col++, "NUMBER");
        int j = 1;
        while ((c = fgetc(fa)) != EOF && isdigit(c))
        {
                tkn.lexeme[j++] = c;
                col++;
        }
        tkn.lexeme[j] = '\0';
        gotToken = 1;
        fseek(fa, -1, SEEK_CUR);
}
else if (c == '#')
{
        while ((c = fgetc(fa)) != EOF && c != '\n');
        newLine();
}
else if (c == '\n')
{
        newLine();
        c = fgetc(fa);
        if (c == '#')
        {
                while ((c = fgetc(fa)) != EOF && c != '\n');
                newLine();
        }
        else if (c != EOF)
        {
                fseek(fa, -1, SEEK_CUR);
        }
}
else if (isspace(c))
{
        ++col;
```

```
}
else if (isalpha(c) || c == '_')
{
	tkn.row = row;
	tkn.col = col++;
	tkn.lexeme[0] = c;
	int j = 1;
	while ((c = fgetc(fa)) != EOF && isalnum(c))
	{
		tkn.lexeme[j++] = c;
		col++;
	}
	tkn.lexeme[j] = '\0';
	if (isKeyword(tkn.lexeme))
	{
		strcpy(tkn.type, "KEYWORD");
	}
	else
	{
		strcpy(tkn.type, "IDENTIFIER");
	}
	gotToken = 1;
	fseek(fa, -1, SEEK_CUR);
}
else if (c == '/')
{
	int d = fgetc(fa);
	++col;
	if (d == '/')
	{
		while ((c = fgetc(fa)) != EOF && c != '\n')
		{
			++col;
		}
		if (c == '\n')
		{
			newLine();
```

```
                }
        }
        else if (d == '*')
        {
                do
                {
                        if (d == '\n')
                        {
                                newLine();
                        }
                        while ((c == fgetc(fa)) != EOF && c != '*')
                        {
                                ++col;
                                if (c == '\n')
                                {
                                        newLine();
                                }
                        }
                        ++col;
                } while ((d == fgetc(fa)) != EOF && d != '/' && (++col));
                ++col;
        }
        else
        {
                fillToken(&tkn, c, row, --col, "ARITHMETIC OPERATOR");
                gotToken = 1;
                fseek(fa, -1, SEEK_CUR);
        }
}
else if (c == '"')
{
        tkn.row = row;
        tkn.col = col;
        strcpy(tkn.type, "STRING LITERAL");
        int k = 1;
        tkn.lexeme[0] = '"';
        while ((c = fgetc(fa)) != EOF && c != '"')
```

```
        {
                tkn.lexeme[k++] = c;
                ++col;
        }
        tkn.lexeme[k] = '';
        gotToken = 1;
}
else if (c == '<' || c == '>' || c == '!')
{
        fillToken(&tkn, c, row, col, "RELATIONALOPERATOR");
        ++col;
        int d = fgetc(fa);
        if (d == '=')
        {
                ++col;
                strcat(tkn.lexeme, "=");
        }
        else
        {
                if (c == '!')
                {
                        strcpy(tkn.type, "LOGICALOPERATOR");
                }
                fseek(fa, -1, SEEK_CUR);
        }
        gotToken = 1;
}
else if (c == '&' || c == '|')
{
        int d = fgetc(fa);
        if (c == d)
        {
                tkn.lexeme[0] = tkn.lexeme[1] = c;
                tkn.lexeme[2] = '\0';
                tkn.row = row;
                tkn.col = col;
                ++col;
```

```
                        gotToken = 1;
                        strcpy(tkn.type, "LOGICALOPERATOR");
                }
                else
                {
                        fseek(fa, -1, SEEK_CUR);
                }
                ++col;
        }
        else
        {
                ++col;
        }
    }
    return tkn;
}
```

Main runner code

```
#include <stdio.h>
#include <stdlib.h>
#include <ctype.h>
#include <string.h>
#include "lex.c"
void program();
void declarations();
void datatype();
void idlist();
void idlistprime();
void assignstat();
void statementlist();
void statement();
void expn();
void eprime();
void simpleexp();
void seprime();
void term();
void tprime();
```

```
void factor();
void relop();
void addop();
void mulop();
struct token tkn;
FILE *f1;
char *rel[] = {"==", "!=", "<=", ">=", ">", "<"};
char *add[] = {"+", "-"};
char *mul[] = {"*", "/", "%"};
int isrel(char *w)
{
    int i;
    for (i = 0; i < sizeof(rel) / sizeof(char*); i++)
    {
        if (strcmp(w, rel[i]) == 0)
        {
            return 1;
        }
    }
    return 0;
}
int isadd(char *w)
{
    int i;
    for (i = 0; i < sizeof(add) / sizeof(char*); i++)
    {
        if (strcmp(w, add[i]) == 0)
        {
            return 1;
        }
    }
    return 0;
}
int ismul(char *w)
{
    int i;
    for (i = 0; i < sizeof(mul) / sizeof(char*); i++)
```

```
    {
        if (strcmp(w, mul[i]) == 0)
        {
            return 1;
        }
    }
    return 0;
}
int main()
{
    FILE *fa, *fb;
    int ca, cb;
    fa = fopen("input.c", "r");
    if (fa == NULL) {
        printf("Cannot open file \n");
        exit(0);
    }

    fb = fopen("week8out.c", "w+");
    ca = getc(fa);
    while (ca != EOF) {
        if (ca == ' ')
        {
            putc(ca, fb);
            while (ca == ' ')
                ca = getc(fa);
        }
        if (ca == '/')
        {
            cb = getc(fa);
            if (cb == '/')
            {
                while (ca != '\n')
                    ca = getc(fa);
            }
            else if (cb == '*')
            {
```

```
                do
                {
                        while (ca != '*')
                                ca = getc(fa);
                        ca = getc(fa);
                } while (ca != '/');
        }
        else {
                putc(ca, fb);
                putc(cb, fb);
        }
    }
    else putc(ca, fb);
    ca = getc(fa);
}
fclose(fa);
fclose(fb);
fa = fopen("week8out.c", "r");
if (fa == NULL) {
    printf("Cannot open file");
    return 0;
}
fb = fopen("temp.c", "w+");
ca = getc(fa);
while (ca != EOF)
{
    if (ca == '"')
    {
        putc(ca, fb);
        ca = getc(fa);
        while (ca != '"')
        {
                putc(ca, fb);
                ca = getc(fa);
        }
    }
    else if (ca == '#')
```

```
	{

		while (ca != '\n')
		{

			ca = getc(fa);

		}
		ca = getc(fa);
	}
	putc(ca, fb);
	ca = getc(fa);
}
fclose(fa);
fclose(fb);

fa = fopen("temp.c", "r");
fb = fopen("week8out.c", "w");
ca = getc(fa);
while (ca != EOF) {
	putc(ca, fb);
	ca = getc(fa);
}
fclose(fa);
fclose(fb);
remove("temp.c");
f1 = fopen("week8out.c", "r");
if (f1 == NULL)
{
	printf("Error! File cannot be opened!\n");
	return 0;
}

while ((tkn = getNextToken(f1)).row != -1)
{
	if (strcmp(tkn.lexeme, "main") == 0)
	{
```

```
                program();
                break;
        }
    }
    fclose(f1);
}
void program()
{

    if (strcmp(tkn.lexeme, "main") == 0)
    {
        tkn = getNextToken(f1);
        if (strcmp(tkn.lexeme, "(") == 0)
        {
                tkn = getNextToken(f1);
                if (strcmp(tkn.lexeme, ")") == 0)
                {
                        tkn = getNextToken(f1);
                        if (strcmp(tkn.lexeme, "{") == 0)
                        {
                                tkn = getNextToken(f1);
                                declarations();
                                statementlist();
                                if (strcmp(tkn.lexeme, "}") == 0)
                                {
                                        printf("Compiled successfully");
                                        return;
                                }
                                else
                                {
                                        printf("} missing at row=%d col=%d", tkn.row,
tkn.col);
                                        exit(1);
                                }
                        }
                        else
                        {
```

```
                        printf("{ missing at row=%d col=%d", tkn.row, tkn.col);
                        exit(1);
                    }
                }
                else
                {
                    printf(") missing at row=%d col=%d", tkn.row, tkn.col);
                    exit(1);
                }
            }
            else
            {
                printf("( missing at row=%d col=%d", tkn.row, tkn.col);
                exit(1);
            }
        }
}
void declarations()
{
    if (isdtype(tkn.lexeme) == 0)
    {
        return;
    }
    datatype();
    idlist();
    if (strcmp(tkn.lexeme, ";") == 0)
    {
        tkn = getNextToken(f1);
        declarations();
    }
    else
    {
        printf("; missing at row=%d col=%d", tkn.row, tkn.col);
        exit(1);
    }
}
void datatype()
```

```
{
   if (strcmp(tkn.lexeme, "int") == 0)
   {
        tkn = getNextToken(f1);
        return;
   }
   else if (strcmp(tkn.lexeme, "char") == 0)
   {
        tkn = getNextToken(f1);
        return;
   }
   else
   {
        printf("%s Missing datatype at row=%d col=%d", tkn.lexeme, tkn.row,
tkn.col);
        exit(1);
   }
}
void idlist()
{
   if (strcmp(tkn.type, "IDENTIFIER") == 0)
   {
        tkn = getNextToken(f1);
        idlistprime();
   }
   else
   {
        printf("Missing IDENTIFIER at row=%d col=%d", tkn.row, tkn.col);
   }
}
void idlistprime()
{
   if (strcmp(tkn.lexeme, ",") == 0)
   {
        tkn = getNextToken(f1);
        idlist();
   }
```

```
    if (strcmp(tkn.lexeme, "[") == 0)
    {
        tkn = getNextToken(f1);
        if (strcmp(tkn.type, "NUMBER") == 0)
        {
            tkn = getNextToken(f1);
            if (strcmp(tkn.lexeme, "]") == 0)
            {
                tkn = getNextToken(f1);
                if (strcmp(tkn.lexeme, ",") == 0)
                {
                    tkn = getNextToken(f1);
                    idlist();
                }
                else
                {
                    return;
                }
            }
        }
    }
    else
    {
        return;
    }
}
void statementlist()
{
    if (strcmp(tkn.type, "IDENTIFIER") != 0)
    {
        return;
    }
    statement();
    statementlist();
}
void statement()
{
```

```
    assignstat();
    if (strcmp(tkn.lexeme, ";") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
}
void assignstat()
{
    if (strcmp(tkn.type, "IDENTIFIER") == 0)
    {
        tkn = getNextToken(f1);
        if (strcmp(tkn.lexeme, "=") == 0)
        {
            tkn = getNextToken(f1);
            expn();
        }
        else
        {
            printf("= missing at row=%d col=%d", tkn.row, tkn.col);
            exit(1);
        }
    }
    else
    {
        printf("Missing IDENTIFIER at row=%d col=%d", tkn.row, tkn.col);
        exit(1);
    }
}
void expn()
{
    simpleexp();
    eprime();
}
void eprime()
{
    if (isrel(tkn.lexeme) == 0)
```

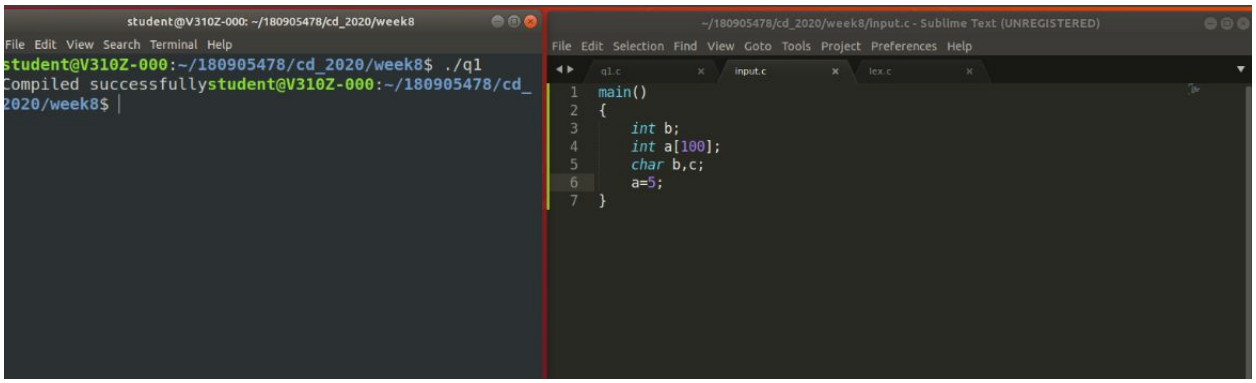
```
    {
        return;
    }
    relop();
    simpleexp();
}
void simpleexp()
{
    term();
    seprime();
}
void seprime()
{
    if (isadd(tkn.lexeme) == 0)
    {
        return;
    }
    addop();
    term();
    seprime();
}
void term()
{
    factor();
    tprime();
}
void tprime()
{
    if (ismul(tkn.lexeme) == 0)
    {
        return;
    }
    mulop();
    factor();
    tprime();
}
void factor()
```

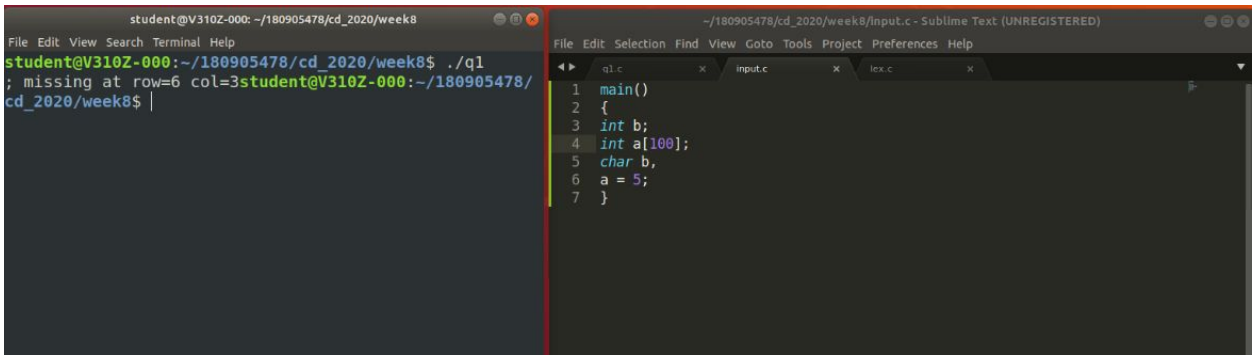
```
{
    if (strcmp(tkn.type, "IDENTIFIER") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
    else if (strcmp(tkn.type, "NUMBER") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
}
void relop()
{
    if (strcmp(tkn.lexeme, "==") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
    if (strcmp(tkn.lexeme, "!=") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
    if (strcmp(tkn.lexeme, "<=") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
    if (strcmp(tkn.lexeme, ">=") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
    if (strcmp(tkn.lexeme, "<") == 0)
    {
        tkn = getNextToken(f1);
```

```
        return;
    }
    if (strcmp(tkn.lexeme, ">") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
}
void addop()
{
    if (strcmp(tkn.lexeme, "+") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
    if (strcmp(tkn.lexeme, "-") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
}
void mulop()
{
    if (strcmp(tkn.lexeme, "*") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
    if (strcmp(tkn.lexeme, "/") == 0)
    {
        tkn = getNextToken(f1);
        return;
    }
    if (strcmp(tkn.lexeme, "*") == 0)
    {
        tkn = getNextToken(f1);
        return;
```

```
    }
}
```

Screenshot :


student@V310Z-000: ~/180905478/cd_2020/week8
File Edit View Search Terminal Help
student@V310Z-000:~/180905478/cd_2020/week8$ ./q1
Compiled successfullystudent@V310Z-000:~/180905478/cd_
2020/week8$
~/180905478/cd_2020/week8/input.c - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
q1.c
input.c
lex.c
1 main()
2 {
3 int b;
4 int a[100];
5 char b,c;
6 a=5;
7 }


student@V310Z-000: ~/180905478/cd_2020/week8
File Edit View Search Terminal Help
student@V310Z-000:~/180905478/cd_2020/week8$ ./q1
; missing at row=6 col=3student@V310Z-000:~/180905478/
cd_2020/week8$
~/180905478/cd_2020/week8/input.c - Sublime Text (UNREGISTERED)
File Edit Selection Find View Goto Tools Project Preferences Help
q1.c
input.c
lex.c
1 main()
2 {
3 int b;
4 int a[100];
5 char b,
6 a = 5;
7 }