LAB-4 Compiler Design -> Symbol Table

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Q1
Code:
```
/*
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DATE  :11 DEC,2020
USAGE : ./q1 sampleIn.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"
};

const char *datatypes[]={"int","char","void","float","bool"};
int isdatatype(char *word){
   //to check if its datatype or not
   int i;
   for(i=0;i<sizeof(datatypes)/sizeof(char*);i++){
         if(strcmp(word,datatypes[i])==0){
               return 1;
         }
   }
   return 0;
}
int isKeyword(char *word){
```

```
            int i;
            for(i=0;i<sizeof(keywords)/sizeof(char*);i++){
            if(strcmp(word,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  %d\n",tab[i].sno,tab[i].lexeme,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){
    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);
                    gotToken=1;
                    ++col;
            }
            else if(charIs(c,arithmeticsymbols))
            {
                    fseek(fa,-1,SEEK_CUR);
                    c=getc(fa);
                    if(isalnum(c)){
                    fillToken(&tkn,c,row,col);
                    gotToken=1;
                    ++col;
                    }
                    fseek(fa,1,SEEK_CUR);
            }
            else if(c=='(')
            {
                    fillToken(&tkn,c,row,col);
                    gotToken=1;
                    col++;
            }
            else if(c==')')
            {
                    fillToken(&tkn,c,row,col);
                    gotToken=1;
                    col++;
            }
            else if(c=='{')
            {
                    fillToken(&tkn,c,row,col);
                    gotToken=1;
                    col++;
            }
```

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

```
                fseek(fa,-1,SEEK_CUR);
            }
            else
            {
                fillToken(&tkn,c,row,col);
                strcpy(tkn.lexeme,"++");
                gotToken=1;
                col+=2;
            }
        }
        else if(c=='=')
        {
            int x=fgetc(fa);
            if(x!='=')
            {
                fillToken(&tkn,c,row,col);
                gotToken=1;
                col++;
                fseek(fa,-1,SEEK_CUR);
            }
            else
            {
                fillToken(&tkn,c,row,col);
                strcpy(tkn.lexeme,"++");
                gotToken=1;
                col+=2;
            }
        }
        else if(isdigit(c))
        {
            fillToken(&tkn,c,row,col++);
            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);
        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);
            ++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;
}
int main()
{
  FILE *fa, *fb;
       int ca, cb;
       fa = fopen("sampleIn.c", "r");
       if (fa == NULL){
       printf("[ERROR] Cannot open file for reading . \n");
       exit(0);
       }

       fb = fopen("sampleout.c", "w+");
       if (fb == NULL){
       printf("[ERROR] Cannot open file for writing. \n");
       exit(0);
       }

       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("sampleout.c", "r");
if(fa == NULL){
    printf("[ERROR] Cannot open file");
    return 0;
}

fb = fopen("temp.c", "w+");
if (fb == NULL){
    printf("[ERROR] Cannot open file for writing. \n");
    exit(0);
    }

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);

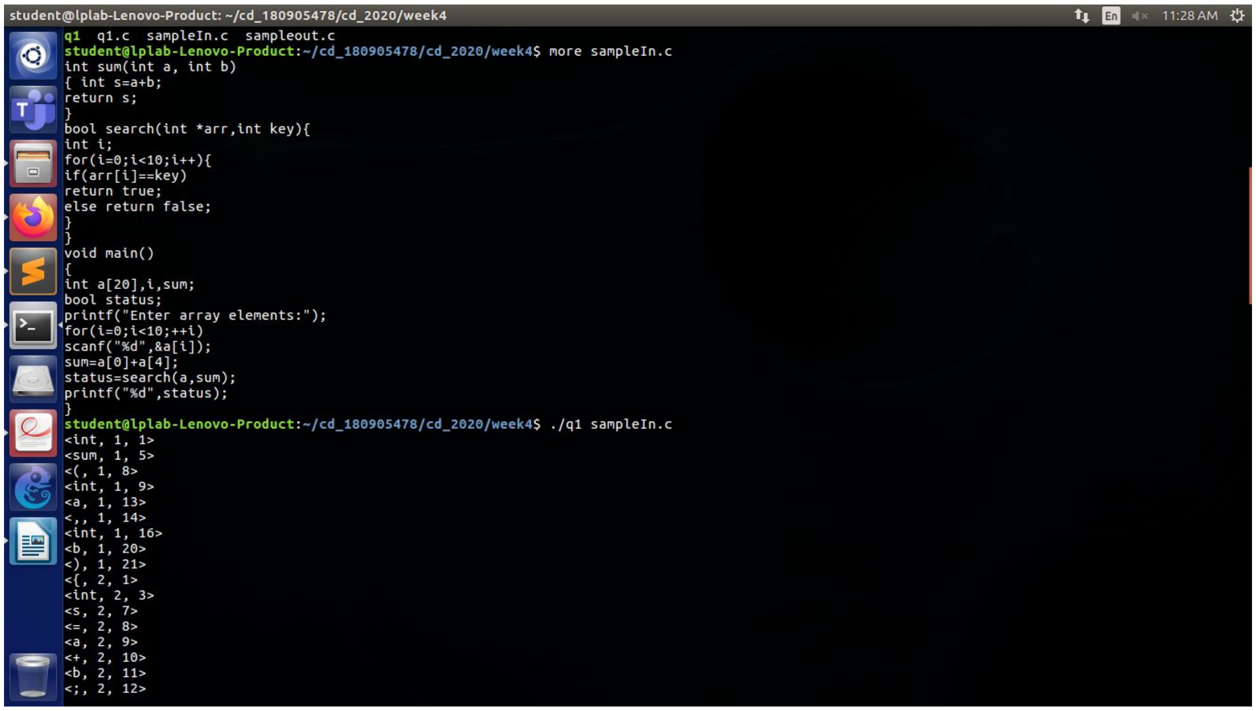
        }
        ca=getc(fa);
        }
        putc(ca,fb);
        ca = getc(fa);
        }
fclose(fa);
fclose(fb);

fa = fopen("temp.c", "r");
fb = fopen("sampleout.c", "w");
ca = getc(fa);
while(ca != EOF){
        putc(ca, fb);
        ca = getc(fa);
}
fclose(fa);
fclose(fb);
remove("temp.c");
FILE *f1=fopen("sampleout.c","r");
if(f1==NULL){
        printf("[ERROR] File cannot be opened!\n");
        return 0;
}
struct token tkn;
struct sttable st[10][100];
int flag=0,i=0,j=0;
int tabsz[10];
char w[25];
w[0]='\0';
while((tkn=getNextToken(f1)).row!=-1)
{
        printf("<%s, %d, %d>\n",tkn.lexeme,tkn.row,tkn.col);
        if(strcmp(tkn.type,"KEYWORD")==0)
```

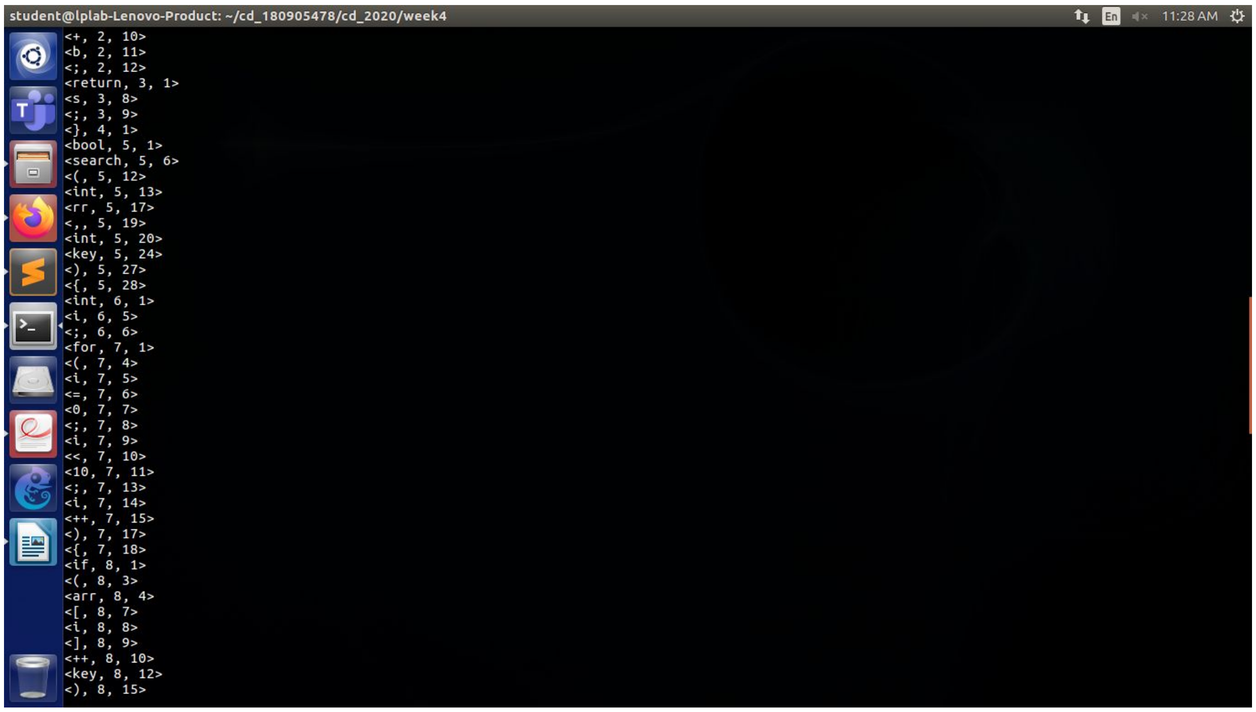
```
{
    if(isdatatype(tkn.lexeme)==1)
    {
        strcpy(dbuf,tkn.lexeme);
    }
}
else if(strcmp(tkn.type,"IDENTIFIER")==0)
{
        strcpy(w,tkn.lexeme);
        tkn=getNextToken(f1);
        printf("<%s, %d, %d>\n",tkn.lexeme,tkn.row,tkn.col);
        if((strcmp(tkn.type,"LB"))==0)
        {
                if(findTable(st[i],w,j)==0)
                {
                        ind++;
                        st[i][j++]=fillTable(ind,w,dbuf,"func",-1);
                }
        }
        if((strcmp(tkn.type,"LS"))==0)
        {
                if(findTable(st[i],w,j)==0)
                {
                        tkn=getNextToken(f1);
                        printf("<%s, %d, %d>\n",tkn.lexeme,tkn.row,tkn.col);
                        int s=0;
                        if(strcmp(tkn.type,"NUMBER")==0)
                        {
                                s=atoi(tkn.lexeme);
                        }
                        ind++;
                        st[i][j++]=fillTable(ind,w,dbuf,"id",sz(dbuf)*s);
                }
        }
        else
        {
                if(findTable(st[i],w,j)==0)
                {
                        ind++;
                        st[i][j++]=fillTable(ind,w,dbuf,"id",sz(dbuf));
                }
        }
}
else if(strcmp(tkn.type,"LC")==0)
```

```
            {
                        flag++;
            }
            else if(strcmp(tkn.type,"RC")==0)
            {
                        flag--;
                        if(flag==0)
                        {
                                    tabsz[i]=j;
                                    i++;
                                    j=0;
                                    ind=0;
                        }
            }
    }
    int k=0;
    for(k=0;k<i;k++)
    {
            printTable(st[k],tabsz[k]);
            printf("********-------*********------********\n\n");
    }
           fclose(f1);

}
```
Screenshot:

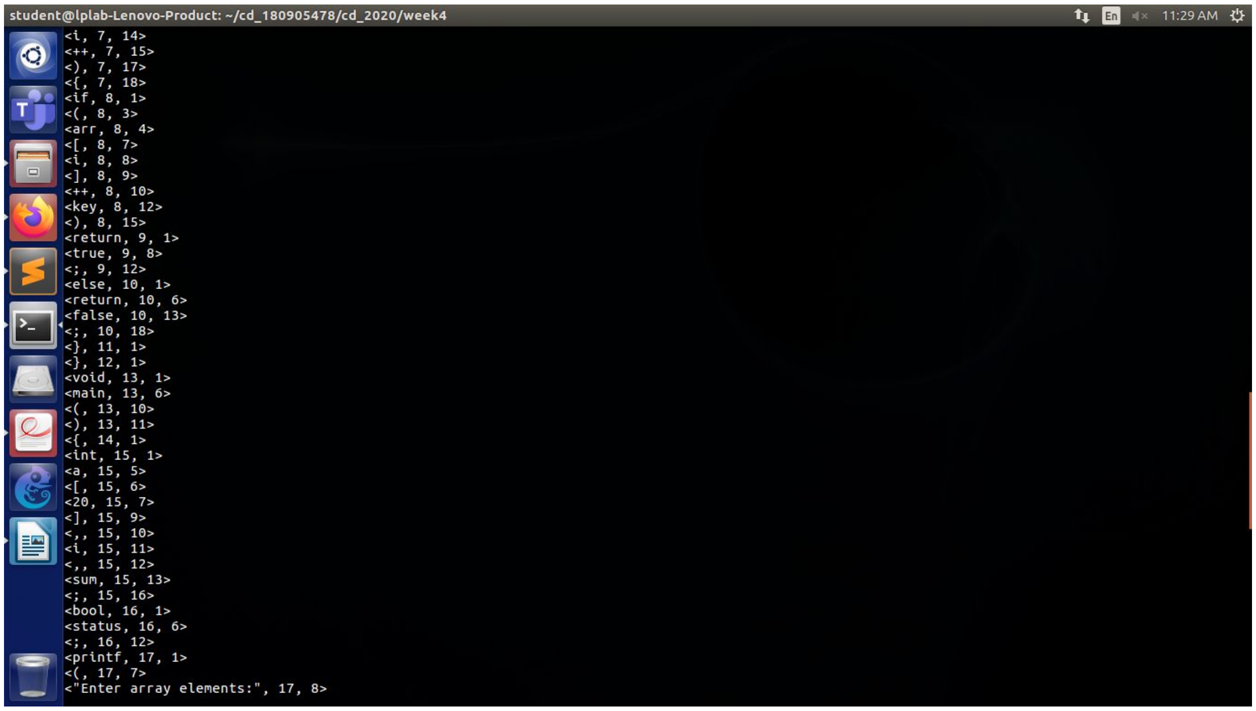


```
student@lplab-Lenovo-Product: ~/cd_180905478/cd_2020/week4
q1  q1.c  sampleIn.c  sampleout.c
student@lplab-Lenovo-Product:~/cd_180905478/cd_2020/week4$ more sampleIn.c
int sum(int a, int b)
{ int s=a+b;
return s;
}
bool search(int *arr,int key){
int i;
for(i=0;i<10;i++){
if(arr[i]==key)
return true;
else return false;
}
}
void main()
{
int a[20],i,sum;
bool status;
printf("Enter array elements:");
for(i=0;i<10;++i)
scanf("%d",&a[i]);
sum=a[0]+a[4];
status=search(a,sum);
printf("%d",status);
}
student@lplab-Lenovo-Product:~/cd_180905478/cd_2020/week4$ ./q1 sampleIn.c
<int, 1, 1>
<sum, 1, 5>
<(, 1, 8>
<int, 1, 9>
<a, 1, 13>
<,, 1, 14>
<int, 1, 16>
<b, 1, 20>
<), 1, 21>
<{, 2, 1>
<int, 2, 3>
<s, 2, 7>
<=, 2, 8>
<a, 2, 9>
<+, 2, 10>
<b, 2, 11>
<;, 2, 12>
```



student@lplab-Lenovo-Product: ~/cd_180905478/cd_2020/week4

```
<+, 2, 10>
<b, 2, 11>
<;, 2, 12>
<return, 3, 1>
<s, 3, 8>
<;, 3, 9>
<}, 4, 1>
<bool, 5, 1>
<search, 5, 6>
<(, 5, 12>
<int, 5, 13>
<rr, 5, 17>
<,, 5, 19>
<int, 5, 20>
<key, 5, 24>
<), 5, 27>
<{, 5, 28>
<int, 6, 1>
<i, 6, 5>
<;, 6, 6>
<for, 7, 1>
<(, 7, 4>
<i, 7, 5>
<=, 7, 6>
<0, 7, 7>
<;, 7, 8>
<i, 7, 9>
<<, 7, 10>
<10, 7, 11>
<;, 7, 13>
<i, 7, 14>
<++, 7, 15>
<), 7, 17>
<{, 7, 18>
<if, 8, 1>
<(, 8, 3>
<arr, 8, 4>
<[, 8, 7>
<i, 8, 8>
<], 8, 9>
<++, 8, 10>
<key, 8, 12>
<), 8, 15>
```



student@lplab-Lenovo-Product: ~/cd_180905478/cd_2020/week4

```
<i, 7, 14>
<++, 7, 15>
<), 7, 17>
<{, 7, 18>
<if, 8, 1>
<(, 8, 3>
<arr, 8, 4>
<[, 8, 7>
<i, 8, 8>
<], 8, 9>
<++, 8, 10>
<key, 8, 12>
<), 8, 15>
<return, 9, 1>
<true, 9, 8>
<;, 9, 12>
<else, 10, 1>
<return, 10, 6>
<false, 10, 13>
<;, 10, 18>
<}, 11, 1>
<}, 12, 1>
<void, 13, 1>
<main, 13, 6>
<(, 13, 10>
<), 13, 11>
<{, 14, 1>
<int, 15, 1>
<a, 15, 5>
<[, 15, 6>
<20, 15, 7>
<], 15, 9>
<,, 15, 10>
<i, 15, 11>
<,, 15, 12>
<sum, 15, 13>
<;, 15, 16>
<bool, 16, 1>
<status, 16, 6>
<;, 16, 12>
<printf, 17, 1>
<(, 17, 7>
<"Enter array elements:", 17, 8>
```

sampleIn.c :

```
int sum(int a, int b)
{ int s=a+b;
return s;
}
bool search(int *arr,int key){
int i;
for(i=0;i<10;i++){
if(arr[i]==key)
return true;
else return false;
}
}
void main()
{
int a[20],i,sum;
bool status;
printf("Enter array elements:");
for(i=0;i<10;++i)
scanf("%d",&a[i]);
sum=a[0]+a[4];
status=search(a,sum);
printf("%d",status);
}
```

The final symbol table constructed was:

```
<int, 1, 1>
<sum, 1, 5>
<(, 1, 8>
<int, 1, 9>
<a, 1, 13>
<,, 1, 14>
<int, 1, 16>
<b, 1, 20>
<), 1, 21>
<{, 2, 1>
<int, 2, 3>
<s, 2, 7>
<=, 2, 8>
<a, 2, 9>
<+, 2, 10>
<b, 2, 11>
<;, 2, 12>
<return, 3, 1>
<s, 3, 8>
<;, 3, 9>
<}, 4, 1>
<bool, 5, 1>
```

```
<search, 5, 6>
<(, 5, 12>
<int, 5, 13>
<rr, 5, 17>
<,, 5, 19>
<int, 5, 20>
<key, 5, 24>
<), 5, 27>
<{, 5, 28>
<int, 6, 1>
<i, 6, 5>
<;, 6, 6>
<for, 7, 1>
<(, 7, 4>
<i, 7, 5>
<=, 7, 6>
<0, 7, 7>
<;, 7, 8>
<i, 7, 9>
<<, 7, 10>
<10, 7, 11>
<;, 7, 13>
<i, 7, 14>
<++, 7, 15>
<), 7, 17>
<{, 7, 18>
<if, 8, 1>
<(, 8, 3>
<arr, 8, 4>
<[, 8, 7>
<i, 8, 8>
<], 8, 9>
<++, 8, 10>
<key, 8, 12>
<), 8, 15>
<return, 9, 1>
<true, 9, 8>
<;, 9, 12>
<else, 10, 1>
<return, 10, 6>
<false, 10, 13>
<;, 10, 18>
<}, 11, 1>
<}, 12, 1>
```

```
<void, 13, 1>
<main, 13, 6>
<(, 13, 10>
<), 13, 11>
<{, 14, 1>
<int, 15, 1>
<a, 15, 5>
<[, 15, 6>
<20, 15, 7>
<], 15, 9>
<,, 15, 10>
<i, 15, 11>
<,, 15, 12>
<sum, 15, 13>
<;, 15, 16>
<bool, 16, 1>
<status, 16, 6>
<;, 16, 12>
<printf, 17, 1>
<(, 17, 7>
<"Enter array elements:", 17, 8>
<), 17, 29>
<;, 17, 30>
<for, 18, 1>
<(, 18, 4>
<i, 18, 5>
<=, 18, 6>
<0, 18, 7>
<;, 18, 8>
<i, 18, 9>
<<, 18, 10>
<10, 18, 11>
<;, 18, 13>
<++, 18, 14>
<i, 18, 16>
<), 18, 17>
<scanf, 19, 1>
<(, 19, 6>
<"%d", 19, 7>
<,, 19, 9>
<a, 19, 11>
<[, 19, 12>
<i, 19, 13>
<], 19, 14>
<), 19, 15>
<;, 19, 16>
<sum, 20, 1>
<=, 20, 4>
<a, 20, 5>
<[, 20, 6>
<0, 20, 7>
<], 20, 8>
<+, 20, 9>
<a, 20, 10>
<[, 20, 11>
<4, 20, 12>
<], 20, 13>
<;, 20, 14>
<status, 21, 1>
<=, 21, 7>
<search, 21, 8>
<(, 21, 14>
<a, 21, 15>
<,, 21, 16>
<sum, 21, 17>
<), 21, 20>
<;, 21, 21>
<printf, 22, 1>
<(, 22, 7>
<"%d", 22, 8>
<,, 22, 10>
<status, 22, 11>
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