Pcd lab exam

1. **Implementation of lexical analyzer using C programming**

PROGRAM:

```
#include <string.h>
#include <ctype.h>
#include <stdio.h>

void keyword(char str[10]) {
   char keywords[10][10] = {"int", "float", "char", "while", "do", "for", "if"};
   for (int i = 0; i < 7; i++) {
      if (!strcmp(keywords[i], str)) {
         printf("\n%s is a keyword", str);
         return;
      }
   }
   printf("\n%s is an identifier", str);
}

void main() {
   FILE *f1, *f2, *f3, *f4;
   char c, str[10], st1[10];
   int num[100], tokenvalue = 0, i = 0, j = 0, k = 0;

   printf("\nEnter the C program:\n");
   f1 = fopen("input", "w");
   while ((c = getchar()) != EOF) {
      putc(c, f1);
   }
   fclose(f1);
```

```
   f1 = fopen("input", "r");
   f2 = fopen("identifier", "w");
   f3 = fopen("specialchar", "w");
   f4 = fopen("operators", "w");

   while ((c = getc(f1)) != EOF) {
      if (isdigit(c)) {
         tokenvalue = c - '0';
         c = getc(f1);
         while (isdigit(c)) {
            tokenvalue = tokenvalue * 10 + (c - '0');
            c = getc(f1);
         }
         num[i++] = tokenvalue;
         ungetc(c, f1);
      } else if (isalpha(c)) {
         putc(c, f2);
         c = getc(f1);
         while (isalnum(c) || c == '_' || c == '$') {
            putc(c, f2);
            c = getc(f1);
         }
         putc(' ', f2);
         ungetc(c, f1);
      } else if (c == '+' || c == '-' || c == '*' || c == '<' || c == '>' || c == '/' || c == '&' || c == '%'
|| c == '^' || c == '=') {
         putc(c, f4);
      } else {
         putc(c, f3);
```

```
    }
}

fclose(f4);
fclose(f2);
fclose(f3);
fclose(f1);

printf("\nThe constants are: ");
for (j = 0; j < i; j++) {
    printf("%d ", num[j]);
}
printf("\n");

f2 = fopen("identifier", "r");
k = 0;
printf("The keywords and identifiers are:\n");
while ((c = getc(f2)) != EOF) {
    if (c != ' ') {
        str[k++] = c;
    } else {
        str[k] = '\0';
        keyword(str);
        k = 0;
    }
}
fclose(f2);

f3 = fopen("specialchar", "r");
```

```
    printf("\nSpecial characters are: ");
    while ((c = getc(f3)) != EOF) {
        printf("%c ", c);
    }
    fclose(f3);

    f4 = fopen("operators", "r");
    printf("Operators are: ");
    while ((c = getc(f4)) != EOF) {
        printf("%c ", c);
    }
    printf("\n");
    fclose(f4);
}
```

OUPUT:

```
Enter the C program:

The constants are: 6
The keywords and identifiers are:

int is a keyword
a is an identifier
b is an identifier
Special characters are:   Operators are: = +
```

INSTRUCTIONS:

PASTE THE ABOVE PROGRAM IN ONLINE GDB COMPILER AND PASTE THE LINE LIKE

Int a=b+6 in text input box in the down panel and click run.. output will display as above..

2.Implementation of SYMBOLTABLE

PROGRAM:

```
#include <stdio.h>
#include <ctype.h>
#include <string.h>

struct symtab {
   int lineno;
   char var[25], dt[25], val[10];
} sa[20];

void main() {
   int i = 0, max = 0, line = 0;
   char s[25], typ[25], gar[] = "garbage";
   FILE *fn;

   fn = fopen("input.txt", "r");
   if (fn == NULL) {
      printf("Error: Unable to open file.\n");
      return;
   }

   printf("\n\nSYMBOL TABLE MANAGEMENT\n\n");
   printf("Variable\tDatatype\tLine.no.\tValue\n");

   while (!feof(fn)) {
      fscanf(fn, "%s", s);
      if ((strcmp(s, "int") == 0) || (strcmp(s, "float") == 0) || (strcmp(s, "char") == 0)) {
         strcpy(typ, s);
```

```
        line++;
        while (strcmp(s, ";") != 0) {
            i++;
            max = i;
            sa[i].lineno = line;

            fscanf(fn, "%s", s);
            strcpy(sa[i].var, s);
            strcpy(sa[i].dt, typ);

            fscanf(fn, "%s", s);
            if (strcmp(s, "=") == 0) {
                fscanf(fn, "%s", s);
                strcpy(sa[i].val, s);
                fscanf(fn, "%s", s);
            } else {
                strcpy(sa[i].val, gar);
            }

            if (strcmp(s, ",") == 0) {
                continue;
            } else {
                break;
            }
        }
    }
}

for (i = 1; i <= max; i++) {
```

```
        printf("\n%s\t\t%s\t\t%d\t\t%s\n", sa[i].var, sa[i].dt, sa[i].lineno, sa[i].val);
    }
    fclose(fn);
}
```

INPUT.TXT:

```
int a , b = 5 ;
float c ;
char d = " a " ;
```

OUTPUT:

SYMBOL TABLE MANAGEMENT

Variable	Datatype	Line.no.	Value
a	int	1	garbage
b	int	1	5
c	float	2	garbage
d	char	3	"

INSTRUCTIONS

1.open online gdb compiler and paste the above program in code editor and at the left top panel,click on add file and give the filename as “input.txt” and paste the input.txt code in it and then run the program.

3. Implementation of front end of a compiler

PROGRAM

```
#include <stdio.h>
#include <ctype.h>
#include <string.h>

int ag = 0, z = 1;

void main() {
   char a[50], id[50], b[50], op[50], mov[] = "MOVF", mul[] = "MULF", div[] = "DIVF", add[] = "ADDF", sub[] = "SUBF", ti = 0;
   int i = 0, j = 0, k = 0, len = 0, s = 0, e = 0, r = 1, count;
   FILE *fp;

   fp = fopen("out.txt", "w");
   printf("\nEnter the code: ");
   fgets(a, sizeof(a), stdin); // Modified to use fgets for complex input handling

   strcpy(b, a);
   len = strlen(a);

   for (i = 0; i < strlen(b); i++) {
      if (b[i] == '*' || b[i] == '/') {
         for (j = i - 1; b[j] != '-' && b[j] != '+' && b[j] != '*' && b[j] != '/' && b[j] != '='; j--);
         k = j + 1;
         count = 0;
         printf("\nt%d=", ti++);
         for (j = j + 1; count < 2 && b[j] != '\0'; j++) {
            if (b[j + 1] == '+' || b[j + 1] == '-' || b[j + 1] == '*' || b[j + 1] == '/')
```

```
            count++;
         printf("%c", b[j]);
      }
      b[k++] = 't';
      b[k++] = ti - 1 + 48;
      for (j = j, k = k; k < strlen(b); k++, j++)
         b[k] = b[j];
      i = 0;
   }
}

for (i = 0; i < strlen(b); i++) {
   if (b[i] == '+' || b[i] == '-') {
      for (j = i - 1; b[j] != '-' && b[j] != '+' && b[j] != '='; j--);
      k = j + 1;
      count = 0;
      printf("\nt%d=", ti++);
      for (j = j + 1; count < 2 && b[j] != '\0'; j++) {
         if (b[j + 1] == '+' || b[j + 1] == '-')
            count++;
         printf("%c", b[j]);
      }
      b[k++] = 't';
      b[k++] = ti - 1 + 48;
      for (j = j, k = k; k < strlen(b); k++, j++)
         b[k] = b[j];
   }
}
```

```
    printf("\n%s", b);
    fclose(fp);
}
```

INPUT(TEXT)

a = 5 + 3 * 2

OUTPUT

```
Enter the code:
t0= 3 * 2

t1= 5 +t0
a =t1
```

INSTRUCTIONS

1.Paste the c program above in the online gdb compiler and in unput text box give the input as “a = 5 + 3 * 2” and click on run button .output will shown like above..

4. Implementation of the back end of the compiler

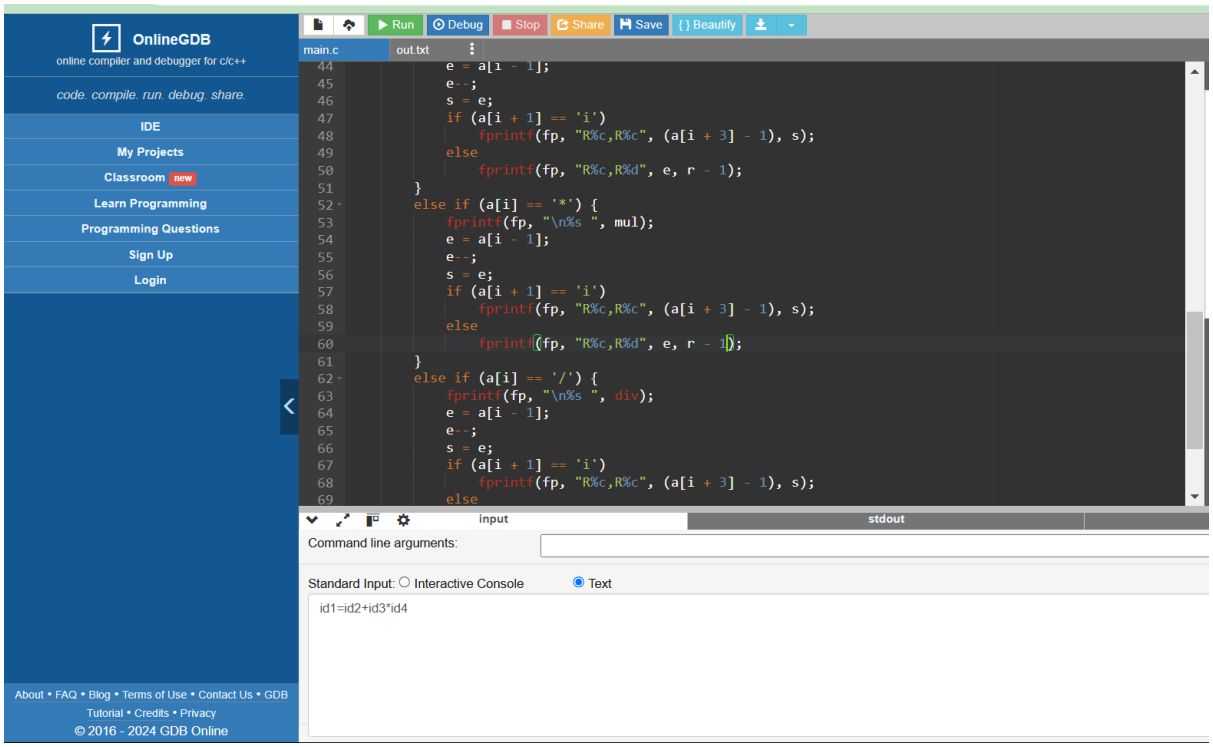
PROGRAM:

```
#include<stdio.h>
#include<ctype.h>
#include<string.h>

int ag = 0, z = 1;

void main() {
   char a[50], id[50], mov[] = "MOVF", mul[] = "MULF", div[] = "DIVF", add[] = "ADDF",
sub[] = "SUBF";
   int i = 0, j = 0, len = 0, s = 0, e = 0, r = 1;
   FILE *fp;

   fp = fopen("out.txt", "w");
   printf("\nEnter the code: ");
   fgets(a, sizeof(a), stdin);  // Using fgets instead of gets for security

   len = strlen(a);
   for (i = 0; i < len; i++) {
      if (a[i] == '=') {
         for (j = i; j < len; j++) {
            if (a[j] == 'i') {  // Looking for 'id'
               fprintf(fp, "\n%s ", mov);
               fprintf(fp, "%c%c%c,R%d", a[j], a[j + 1], a[j + 2], r++);
            }
         }
      }
      else if ((a[i] <= 57) && (a[i] >= 48)) {  // If the character is a digit
         if ((a[i + 1] <= 57) && (a[i + 1] >= 48)) {  // If next character is also a digit
            fprintf(fp, "\n%s #%c%c,R%d", mov, a[i], a[i + 1], r++);
         }
      }
   }

   for (i = len - 1; i >= 0; i--) {
      if (a[i] == '+') {
         fprintf(fp, "\n%s ", add);
         e = a[i - 1];
         e--;
         s = e;
         if (a[i + 1] == 'i')
            fprintf(fp, "R%c,R%d", e, r - 1);
      }
      else if (a[i] == '-') {
         fprintf(fp, "\n%s ", sub);
         e = a[i - 1];
         e--;
         s = e;
         if (a[i + 1] == 'i')
```

```
            fprintf(fp, "R%c,R%c", (a[i + 3] - 1), s);
        else
            fprintf(fp, "R%c,R%d", e, r - 1);
    }
    else if (a[i] == '*') {
        fprintf(fp, "\n%s ", mul);
        e = a[i - 1];
        e--;
        s = e;
        if (a[i + 1] == 'i')
            fprintf(fp, "R%c,R%c", (a[i + 3] - 1), s);
        else
            fprintf(fp, "R%c,R%d", e, r - 1);
    }
    else if (a[i] == '/') {
        fprintf(fp, "\n%s ", div);
        e = a[i - 1];
        e--;
        s = e;
        if (a[i + 1] == 'i')
            fprintf(fp, "R%c,R%c", (a[i + 3] - 1), s);
        else
            fprintf(fp, "R%c,R%d", e, r - 1);
    }
  }
  fprintf(fp, "\n%s R1,id1", mov);
  fclose(fp);
}
```

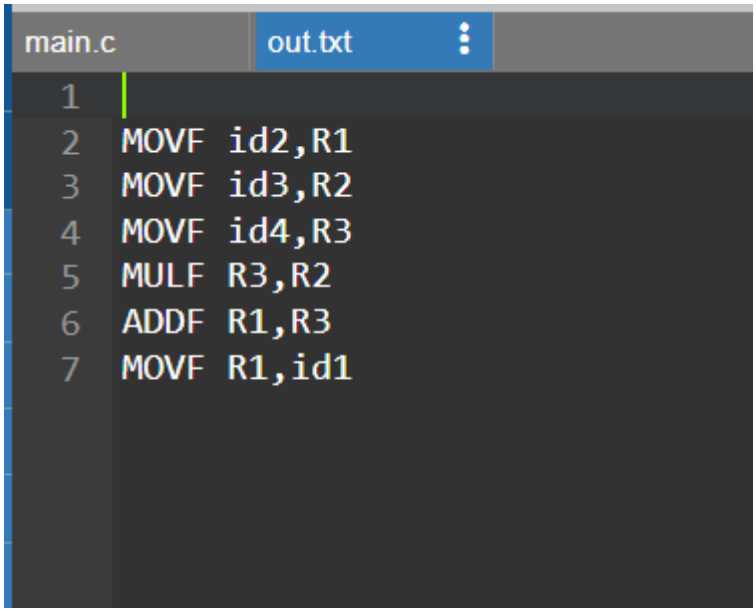
INPUT(TEXT)

id1=id2+id3*id4



OUTPUT:

The output is shown in a generated file “out.txt”



5. Implementation of Code optimization

PROGRAM:

```
#include <stdio.h>
#include <string.h>

struct op {
   char l;     // Left side variable
   char r[20];  // Right side expression
} op[10], pr[10];

void main() {
   int a, i, k, j, n, z = 0, m, q;
   char *p, *l, *tem, temp, t;
   char nu[] = "\0";

   // Input the number of assignments
   printf("\nEnter the number of values: ");
   scanf("%d", &n);

   // Input the intermediate code (assignments)
   for (i = 0; i < n; i++) {
      printf("\nLeft ");
      scanf(" %c", &op[i].l);  // Take the left side variable (char)
      printf("Right ");
      scanf("%s", op[i].r);  // Take the right side expression (string)
   }
```

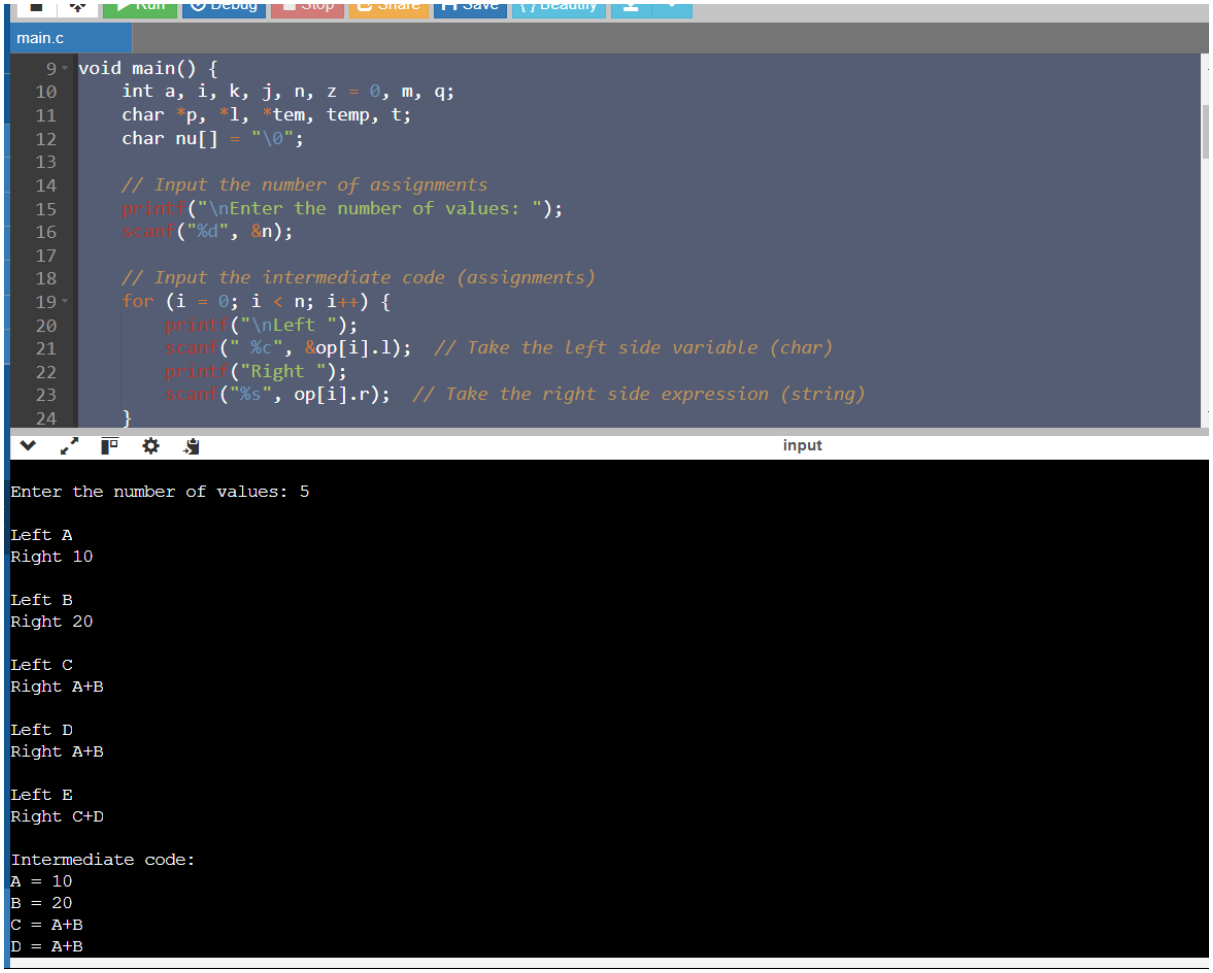
```
// Display the input intermediate code
printf("\nIntermediate code:\n");
for (i = 0; i < n; i++)
   printf("%c = %s\n", op[i].l, op[i].r);

// Dead code elimination: Find left side variables that are not used later
for (i = 0; i < n; i++) {
   temp = op[i].l;
   p = NULL;

   // Check if the left side variable is used on the right side in any future statement
   for (j = 0; j < n; j++) {
      p = strchr(op[j].r, temp);
      if (p) {
         pr[z].l = op[i].l;
         strcpy(pr[z].r, op[i].r);
         z++;
         break;
      }
   }
}

// After dead code elimination
printf("\nAfter dead code elimination:\n");
for (k = 0; k < z; k++)
   printf("%c = %s\n", pr[k].l, pr[k].r);

// Common subexpression elimination: Eliminate common expressions
for (m = 0; m < z; m++) {
```

```
    tem = pr[m].r;

    // Compare current expression with the rest
    for (j = m + 1; j < z; j++) {
        p = strstr(tem, pr[j].r);
        if (p) {
            pr[j].l = pr[m].l;
            for (i = 0; i < z; i++) {
                if (l) {
                    a = l - pr[i].r;
                    pr[i].r[a] = pr[m].l;
                }
            }
        }
    }
}

// Eliminate common expressions
printf("\nEliminated common expressions:\n");
for (i = 0; i < z; i++)
    printf("%c = %s\n", pr[i].l, pr[i].r);

// Final optimized code by removing redundant assignments
for (i = 0; i < z; i++) {
    for (j = i + 1; j < z; j++) {
        q = strcmp(pr[i].r, pr[j].r);
        // Eliminate redundant assignments (common subexpressions)
        if ((pr[i].l == pr[j].l) && !q) {
            pr[i].l = '\0';  // Mark as redundant
```

```
            strcpy(pr[i].r, nu);
          }
        }
    }

    // Print the optimized code
    printf("\nOptimized code:\n");
    for (i = 0; i < z; i++) {
        if (pr[i].l != '\0')
            printf("%c = %s\n", pr[i].l, pr[i].r);
    }
}
```

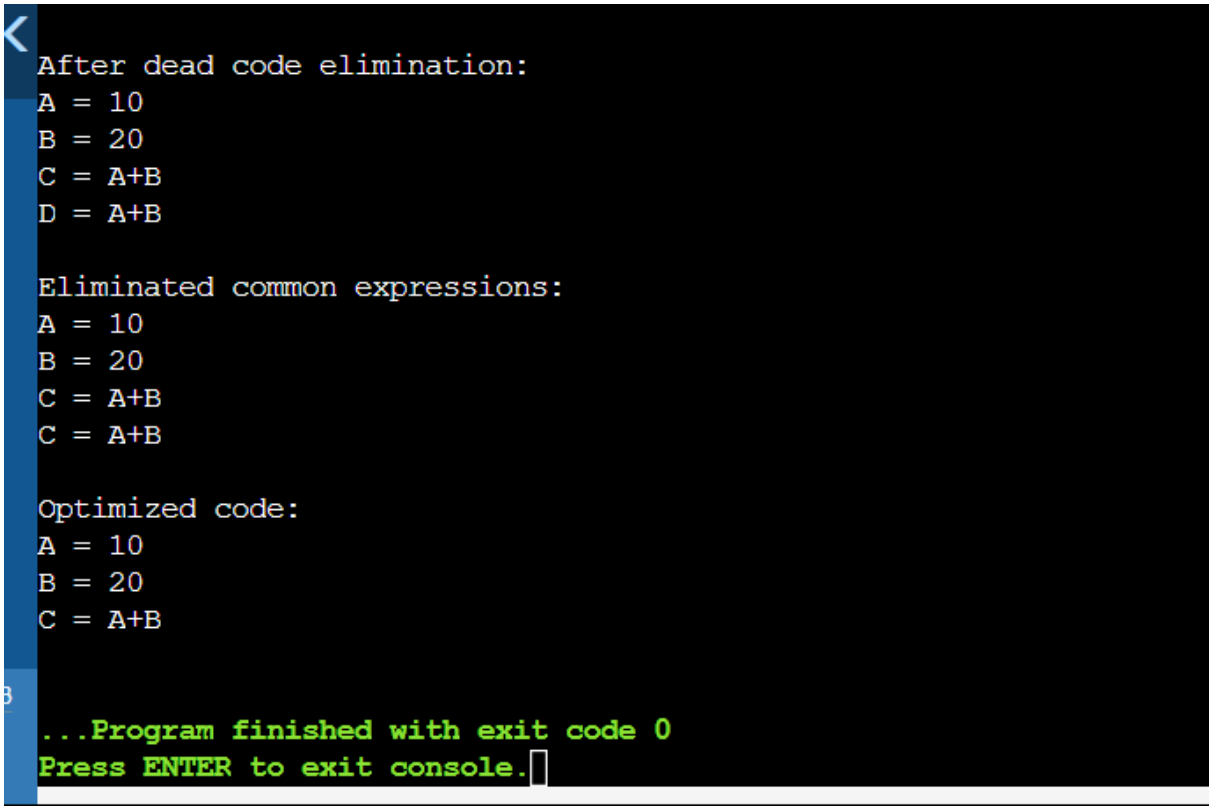
INPUT(INTERACTIVE CONSOLE)

Run the program and give inputs in the console window



OUTPUT:

It will be generated in the console itself


After dead code elimination:
A = 10
B = 20
C = A+B
D = A+B
Eliminated common expressions:
A = 10
B = 20
C = A+B
C = A+B
Optimized code:
A = 10
B = 20
C = A+B
...Program finished with exit code 0
Press ENTER to exit console.