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EXP NO : 11 DATE :

IMPLEMENT CODE OPTIMIZATION TECHNIQUES LIKE DEAD CODE AND COMMON EXPRESSION ELIMINATION

AIM:

The aim is to implement code optimization techniques such as Dead Code Elimination (DCE) and Common Subexpression Elimination (CSE) on an intermediate representation of a program (such as Three-Address Code (TAC)). These optimization techniques help reduce the size of the code, improve runtime performance, and eliminate redundant computations during the compilation process.

ALGORITHM:

- Start
- Create the input file which contains three address code.
- Open the file in read mode.
- If the file pointer returns NULL, exit the program else go to 5.
- Scan the input symbol from left to right.
- Store the first expression in a string.
- Compare the string with the other expressions in the file.
- If there is a match, remove the expression from the input file.
- Perform these steps 5-8 for all the input symbols in the file.
- Scan the input symbol from the file from left to right.
- Get the operand before the operator from the three address code.
- Check whether the operand is used in any other expression in the three address code.
- If the operand is not used, then eliminate the complete expression from the three address code else go to 14.
- Perform steps 11 to 13 for all the operands in the three address code till end of the file is reached.
- Stop.

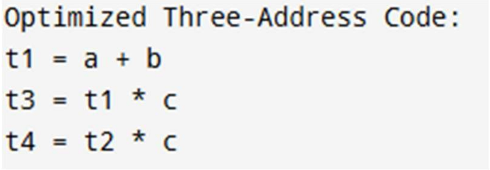
PROGRAM:

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

#define MAX 100
```

```
typedef struct {     char
lhs[20], rhs[50];
} TAC;

int isUsed(TAC tac[], int total, char *var, int current)
{     for (int i = current + 1; i < total; i++) {         if
(strstr(tac[i].rhs, var)) return 1;
    }
return 0;
}

void replaceVar(char *src, char *oldVar, char *newVar) {
    char buffer[100] = "";     char *pos = src,
*match;     while ((match = strstr(pos, oldVar)) !=
NULL) {         strncat(buffer, pos, match - pos);
strcat(buffer, newVar);
        pos = match + strlen(oldVar);
    }     strcat(buffer,
pos);     strcpy(src,
buffer);
}

int main() {
FILE *fp;
    TAC tac[MAX];
    char line[100], *lhs, *rhs;
    int count = 0;

    // Open input file     fp =
fopen("input.txt", "r");
    if (!fp) {         printf("Error: Could not open
'input.txt'\n");
        return 1;
    }

    // Read input file     while
(fgets(line, sizeof(line), fp)) {
line[strcspn(line, "\n")] = 0;         lhs
= strtok(line, "=");         rhs =
strtok(NULL, "\n");         if (lhs &&
rhs) {             strcpy(tac[count].lhs,
lhs);             strcpy(tac[count].rhs,
rhs);             count++;
        }     }
fclose(fp);
```

```
  // Step 1: Common Subexpression Elimination (CSE)
  for (int i = 0; i < count; i++) {        for (int
j = i + 1; j < count; j++) {            if
(strcmp(tac[i].rhs, tac[j].rhs) == 0) {
replaceVar(tac[j + 1].rhs, tac[j].lhs,
tac[i].lhs);
            strcpy(tac[j].lhs, "");
strcpy(tac[j].rhs, "");
        }
      }
  }

  // Step 2: Copy Propagation     for (int i = 0; i < count; i++) {        if
(strchr(tac[i].rhs, '+') == NULL && strchr(tac[i].rhs, '-') == NULL &&
strchr(tac[i].rhs, '*') == NULL && strchr(tac[i].rhs, '/') == NULL) {
        // rhs is a direct copy             for
(int j = i + 1; j < count; j++) {
            replaceVar(tac[j].rhs, tac[i].lhs, tac[i].rhs);
        }
        // mark line as empty
strcpy(tac[i].lhs, "");
strcpy(tac[i].rhs, "");
      }
  }

  // Step 3: Dead Code Elimination     for (int i = 0; i < count;
i++) {        if (tac[i].lhs[0] != '\0' && !isUsed(tac, count,
tac[i].lhs, i)) {           strcpy(tac[i].lhs, "");
strcpy(tac[i].rhs, "");
      }
  }

  // Print Optimized Code
  printf("\nOptimized Code:\n----------------\n");
  for (int i = 0; i < count; i++) {        if
(tac[i].lhs[0] != '\0') {
printf("%s=%s\n", tac[i].lhs, tac[i].rhs);
      }
  }

  return 0;
}
```

OUTPUT :



```
Optimized Three-Address Code:
t1 = a + b
t3 = t1 * c
t4 = t2 * c
```

Implementation	
Output/Signature	

RESULT:

Thus The Above Program To Implement Code Optimization Techniques Like Dead Code And Common Expression Elimination Is Executed And Implemented Successfully.