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Lab Exp.: 08

Aim: To write a program that implements the target code generation.

Code:

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

// Global variables
int label[20]; // Array to store instruction numbers that are jump targets
int no = 0;    // Counter for the number of labels stored

// Function to check if a given instruction number 'k' is a jump target
int check_label(int k) {
   int i;
   for (i = 0; i < no; i++) {
      if (k == label[i])
         return 1; // It is a jump target
   }
   return 0; // It is not a jump target
}

int main() {
   FILE *fp1, *fp2;
   char fname[10], op[10], ch;
   char operand1[8], operand2[8], result[8];
   int i = 0, j = 0;

   printf("\n Enter filename of the intermediate code: ");
   scanf("%s", fname);

   // Open the intermediate code file for reading and the target file for writing
   fp1 = fopen(fname, "r");
   fp2 = fopen("target.txt", "w");

   if (fp1 == NULL || fp2 == NULL) {
      printf("\n Error opening the file");
```

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    exit(0);
}

// Process the intermediate code file line by line
while (!feof(fp1)) {
    fprintf(fp2, "\n"); // New line for formatting in the target file
    fscanf(fp1, "%s", op); // Read the operation/opcode

    // Increment the instruction counter
    i++;

    // Check if the current instruction is a target of a previous jump
    if (check_label(i)) {
        fprintf(fp2, "\nlabel#%d:", i); // Print the label
    }

    // --- Specific Operations (using strcmp for multi-character opcodes) ---

    // PRINT operation
    if (strcmp(op, "print") == 0) {
        fscanf(fp1, "%s", result);
        fprintf(fp2, "\n\t OUT %s", result);
    }

    // GOTO operation (Unconditional Jump)
    else if (strcmp(op, "goto") == 0) {
        fscanf(fp1, "%s %s", operand1, operand2); // Reads condition and target instruction number
        fprintf(fp2, "\n\t JMP %s,label#%s", operand1, operand2);
        label[no++] = atoi(operand2); // Store the target instruction number as a label
    }

    // Array assignment: []= (e.g., A[i] = B)
    else if (strcmp(op, "[]=") == 0) {
        fscanf(fp1, "%s %s %s", operand1, operand2, result);
        // Assuming intermediate code is: []= A i B (meaning A[i] = B)
        fprintf(fp2, "\n\t STORE %s[%s],%s", operand1, operand2, result);
    }

    // Unary Minus operation: uminus (e.g., T1 = uminus A)
    else if (strcmp(op, "uminus") == 0) {
        fscanf(fp1, "%s %s", operand1, result); // Reads operand and result
        fprintf(fp2, "\n\t LOAD -%s,R1", operand1); // Load the negative value into R1
```

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   fprintf(fp2, "\n\t STORE R1,%s", result);    // Store R1 into the result variable
}

// --- Arithmetic and Relational Operations (using switch for single-character opcodes) ---
else {
   switch (op[0]) {
      case '*': // Multiplication: * A B T1 (T1 = A * B)
         fscanf(fp1, "%s %s %s", operand1, operand2, result);
         // NOTE: The original code's LOAD line is missing an operand. Correcting to a likely intent.
         // Original: fprintf(fp2,"\n \tLOAD",operand1);
         fprintf(fp2, "\n \t LOAD %s,R0", operand1);
         fprintf(fp2, "\n \t LOAD %s,R1", operand2);
         fprintf(fp2, "\n \t MUL R1,R0"); // R0 = R0 * R1
         fprintf(fp2, "\n \t STORE R0,%s", result);
         break;

      case '+': // Addition: + A B T1 (T1 = A + B)
         fscanf(fp1, "%s %s %s", operand1, operand2, result);
         fprintf(fp2, "\n \t LOAD %s,R0", operand1);
         fprintf(fp2, "\n \t LOAD %s,R1", operand2);
         fprintf(fp2, "\n \t ADD R1,R0"); // R0 = R0 + R1
         fprintf(fp2, "\n \t STORE R0,%s", result);
         break;

      case '-': // Subtraction: - A B T1 (T1 = A - B)
         fscanf(fp1, "%s %s %s", operand1, operand2, result);
         fprintf(fp2, "\n\t LOAD %s,R0", operand1); // Load A into R0
         fprintf(fp2, "\n \tLOAD %s,R1", operand2); // Load B into R1
         fprintf(fp2, "\n \t SUB R1,R0"); // R0 = R0 - R1 (A - B)
         fprintf(fp2, "\n \t STORE R0,%s", result);
         break;

      case '/': // Division: / A B T1 (T1 = A / B)
         // NOTE: The original code has a typo: "%s %s s". Correcting to "%s %s %s".
         fscanf(fp1, "%s %s %s", operand1, operand2, result);
         fprintf(fp2, "\n \t LOAD %s,R0", operand1);
         fprintf(fp2, "\n \t LOAD %s,R1", operand2);
         fprintf(fp2, "\n \t DIV R1,R0"); // R0 = R0 / R1
         fprintf(fp2, "\n \t STORE R0,%s", result);
         break;

      case '%': // Modulo (Using DIV instruction, which is often used for MOD/REM)
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            fscanf(fp1, "%s %s %s", operand1, operand2, result);
            fprintf(fp2, "\n \t LOAD %s,R0", operand1);
            fprintf(fp2, "\n \t LOAD %s,R1", operand2);
            fprintf(fp2, "\n \t DIV R1,R0"); // In many architectures, DIV sets a remainder register.
                                    // This code simply uses DIV and stores R0, which is likely incorrect for MOD.
                                    // Sticking to the code's original instruction pattern.
            fprintf(fp2, "\n \t STORE R0,%s", result);
            break;

        case '=': // Assignment: = A T1 (T1 = A)
            fscanf(fp1, "%s %s", operand1, result);
            // NOTE: The instruction STORE is commonly used for this, but the original code is STORE %s %s.
            // Correcting to a more standard pattern: LOAD into a register, then STORE.
            // Sticking to the code's original instruction pattern, assuming it means STORE operand1 to result.
            fprintf(fp2, "\n\t STORE %s, %s", operand1, result);
            break;

        case '>': // Greater Than Conditional Jump: > A B target (If A > B, goto target)
            j++;
            fscanf(fp1, "%s %s %s", operand1, operand2, result); // Reads A, B, and target instruction number
            fprintf(fp2, "\n \t LOAD %s,R0", operand1);         // Load the first operand A into R0
            fprintf(fp2, "\n\t JGT %s,label#%s", operand2, result); // Jump if Greater Than
            label[no++] = atoi(result);
            break;

        case '<': // Less Than Conditional Jump: < A B target (If A < B, goto target)
            fscanf(fp1, "%s %s %s", operand1, operand2, result);
            fprintf(fp2, "\n \t LOAD %s,R0", operand1);
            // NOTE: The original code has a typo: label#%d. Correcting to label#%s to match 'result' being a
string.
            fprintf(fp2, "\n\t JLT %s,label#%s", operand2, result); // Jump if Less Than
            label[no++] = atoi(result);
            break;
        }
    }
}

// Close and reopen the target file to read and display the generated code
fclose(fp2);
fclose(fp1);

fp2 = fopen("target.txt", "r");
```

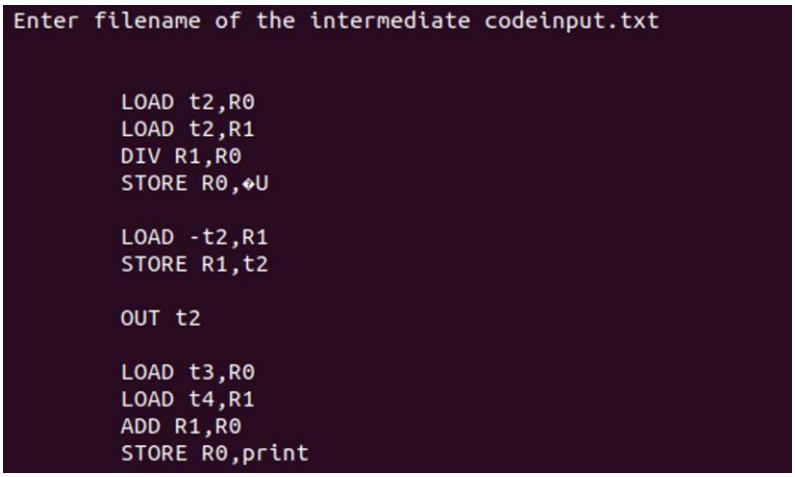
```
    if (fp2 == NULL) {
        printf("Error opening the file\n");
        exit(0);
    }

    // Print the generated target code to the console
    printf("\n\nGenerated Target Code:\n");
    do {
        ch = fgetc(fp2);
        printf("%c", ch);
    } while (ch != EOF);

    fclose(fp2);
    // NOTE: The original code tries to close fp1 again here, which is redundant.

    return 0;
}
```

Output:



Result: Thus, the program to implement the target code generation has been executed successfully.