System Software (CS306)

Assignment - 7

U19CS012

1.) Generate Macro Definition Table(MDT) for given macro definition:

```
MACRO
 CLEARMEM &X, &N, &REG=AREG
 LCL &M
&M SET 0
 MOVER &REG, ='0'
.MORE MOVEM &REG, &X + &M
&M SET &M+1
 IAF (&M NE N) .MORE
 MEND
```

Code

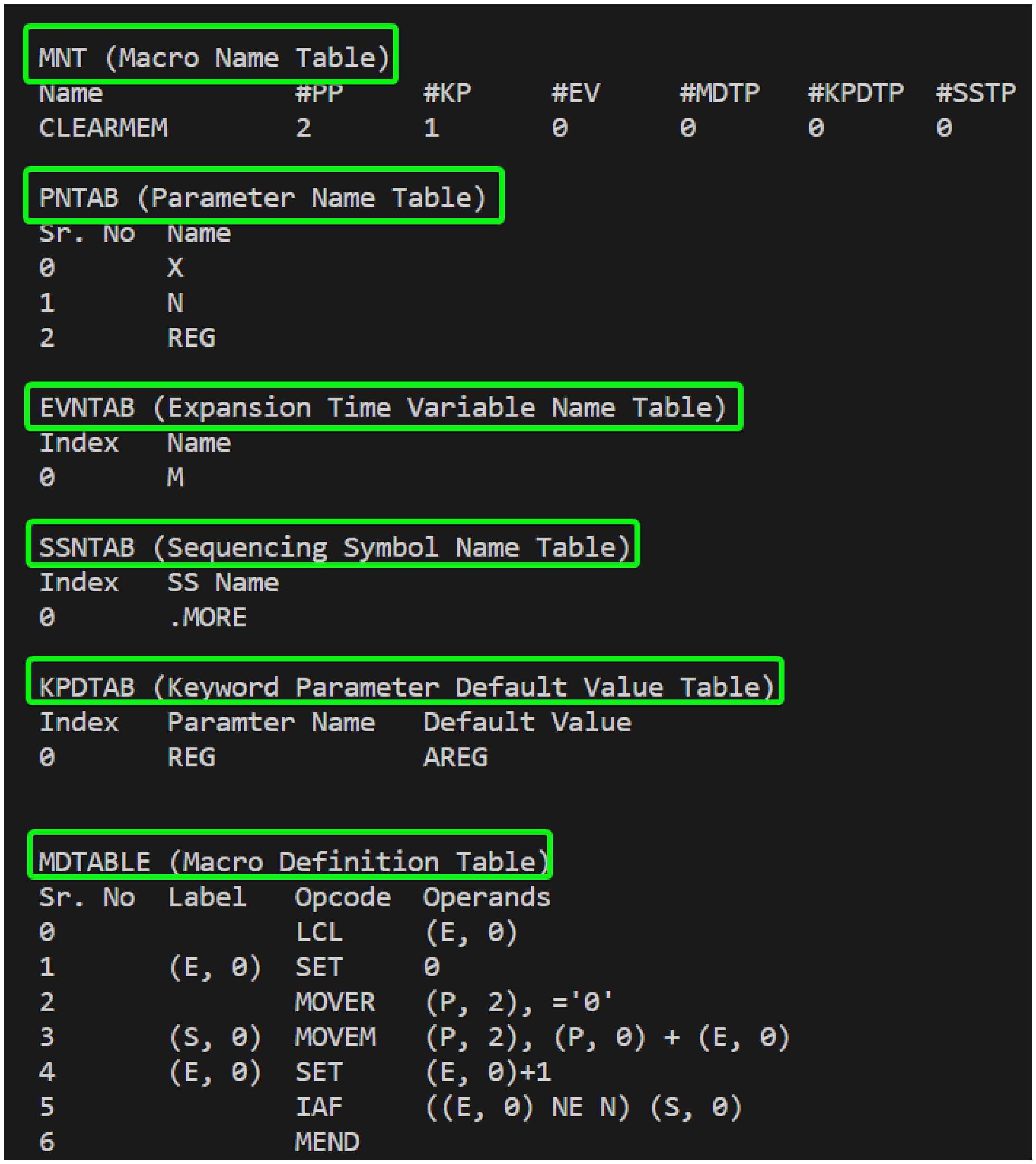
```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <ctype.h>

// Data Structure for MACRO Generation
typedef struct MNT
{
    char name[20];
    int pp;
    int kp;
    int ev;
    int mdtp;
    int kpdtp;
    int sstp;
} MNT;

typedef struct MDT
{
    int index;
    char label[20];
    char opcode[20];
    char operands[100];
} MDT;

typedef struct EVNTAB
{
    int index;
    char name[20];
} EVNTAB;

typedef struct SSNTAB
{
    int index;
    char name[20];
} SSNTAB;

typedef struct PNTAB
{
    int index;
    char name[20];
} PNTAB;

typedef struct KPDTAB
{
    int index;
    char name[20];
    char default_value[20];
} KPDTAB;

MNT mnt[10];
MDT mdtable[20];
EVNTAB evntab[20];
SSNTAB ssntab[20];
PNTAB pntab[20];
KPDTAB kpdtab[20];

// Check if Sequencing Symbol Exist? [If Yes, Return its Index Otherwise Return -1]
int get_SS_idx(char *ss);

// Check if Expansion Variable Exist? [If Yes, Return its Index Otherwise Return -1]
int get_EV_idx(char *ev);

// Check if Parameter Exist? [If Yes, Return its Index Otherwise Return -1]
int get_Parameter_idx(char *p);

// Filter the Input Buffer
int filter_inp(char *name, char *buffer, int i);

// Intial Values of All Tables Counter
int mntc = 0, mdtc = 0, evntc = 0, ssntc = 0, pntc = 0, kpdtc = 0;
```

```c
// Based on Instruction, Updates the Tables
void update_tables(char *buffer);

void main()
{
    FILE *in, *mdt;

    in = fopen("input.txt", "r");

    char buffer[250];
    while (fgets(buffer, 250, in))
    {
        // Start of MACRO Detected
        if (strstr(buffer, "MACRO"))
        {
            fgets(buffer, 250, in);
            strcpy(mnt[mntc].name, strtok(buffer, " "));

            mnt[mntc].mdtp = mdtc;
            mnt[mntc].kpdtp = kpdtc;
            mnt[mntc].sstp = ssntc;

            char *temp;
            while (temp = strtok(NULL, ", "))
            {
                char *param;
                if (param = strchr(temp, '='))
                {
                    mnt[mntc].kp++;

                    // Update the Keyword Parameter Default Table
                    strcpy(kpdtab[kpdtc].default_value, param + 1);
                    strncpy(kpdtab[kpdtc].name, temp + 1, strlen(temp) - strlen(param) - 1);
                    kpdtab[kpdtc].name[strlen(temp) - strlen(param) - 1] = '\0';
                    kpdtab[kpdtc].index = kpdtc;

                    // Update the Parameter Table
                    strcpy(pntab[pntc].name, kpdtab[kpdtc].name);
                    pntab[pntc].index = pntc;

                    kpdtc++;
                    pntc++;
                }
                else
                {
                    mnt[mntc].pp++;

                    // Update the Paramater Table
                    strcpy(pntab[pntc].name, temp + 1);
                    pntab[pntc].index = pntc;
                    pntc++;
                }
            }

            mntc++;

            while (fgets(buffer, 250, in))
            {
                // End of Macro Detected -> Exit from this Loop
                if (strstr(buffer, "MEND"))
                {
                    strcpy(mdtable[mdtc].opcode, "MEND");

                    // Update the Macro Defination Table
                    mdtable[mdtc].index = mdtc;
                    mdtc++;
                    break;
                }
                update_tables(buffer);
            }
        }
    }

    fclose(in);

    // Print the Final Results

    // Macro Name Table
    printf("\nMNT (Macro Name Table)\n");
    printf("Name\t\t#PP\t#KP\t#EV\t#MDTP\t#KPDTP\t#SSTP\n");
    for (int i = 0; i < mntc; i++)
    {
        printf("%s\t%d\t%d\t%d\t%d\t%d\t%d\n", mnt[i].name, mnt[i].pp, mnt[i].kp, mnt[i].ev,
mnt[i].mdtp, mnt[i].kpdtp, mnt[i].sstp);
    }

    // Parameter Name Table
    printf("\nPNTAB (Parameter Name Table)\n");
    printf("Sr. No\tName\n");
    for (int i = 0; i < pntc; i++)
    {
        printf("%d\t%s\n", pntab[i].index, pntab[i].name);
    }

    // Expansion Time Variable Name Table
    printf("\nEVNTAB (Expansion Time Variable Name Table)\n");
    printf("Index\tName\n");
    for (int i = 0; i < evntc; i++)
    {
        printf("%d\t%s\n", evntab[i].index, evntab[i].name);
```

```c
    }

    // Sequencing Symbol Table
    printf("\nSSNTAB (Sequencing Symbol Name Table)\n");
    printf("Index\tSS Name\n");
    for (int i = 0; i < ssntc; i++)
    {
        printf("%d\t%s\n", ssntab[i].index, ssntab[i].name);
    }

    // Keyword Parameter Default Value Table
    printf("\nKPDTAB (Keyword Parameter Default Value Table)\n");
    printf("Index\tParamter Name\tDefault Value\n");
    for (int i = 0; i < kpdtc; i++)
    {
        printf("%d\t%s\t\t%s\n", kpdtab[i].index, kpdtab[i].name, kpdtab[i].default_value);
    }

    // Macro Definition Table
    printf("\nMDTABLE (Macro Definition Table)\n");
    printf("Sr. No\tLabel\tOpcode\tOperands\n");
    for (int i = 0; i < mdtc; i++)
    {
        printf("%d\t%s\t%s\t%s\n", mdtable[i].index, mdtable[i].label, mdtable[i].opcode,
mdtable[i].operands);
    }
}

// Check if Sequencing Symbol Exist? [If Yes, Return its Index Otherwise Return -1]
int get_SS_idx(char *ss)
{
    for (int i = 0; i < 20; i++)
    {
        if (strcmp(ssntab[i].name, ss) == 0)
            return i;
    }
    return -1;
}

// Check if Expansion Variable Exist? [If Yes, Return its Index Otherwise Return -1]
int get_EV_idx(char *ev)
{
    for (int i = 0; i < 20; i++)
    {
        if (strcmp(evntab[i].name, ev) == 0)
            return i;
    }
    return -1;
}
```

```c
// Check if Parameter Exist? [If Yes, Return its Index Otherwise Return -1]
int get_Parameter_idx(char *p)
{
    int i;
    for (i = 0; i < 20; i++)
    {
        if (strcmp(pntab[i].name, p) == 0)
            return i;
    }
    return -1;
}

// Filter the Input Buffer
int filter_inp(char *name, char *buffer, int i)
{
    int j = i;
    if (buffer[i] == '.')
        j++;
    while (isalpha(buffer[j]))
        j++;
    strncpy(name, buffer + i, j - i);
    name[j - i] = '\0';
    return j;
}

// Based on Instruction, Updates the Tables
void update_tables(char *buffer)
{
    char label[20], opcode[20], operands[100], temp[20];

    // Tokenise the Input via " " [SPACE]
    strcpy(label, strtok(buffer, " "));

    // If Input is "." -> Sequencing Symbol & Macro Name Table to be Updated
    if (label[0] == '.')
    {
        ssntab[ssntc].index = ssntc;
        strcpy(ssntab[ssntc].name, label);
        sprintf(mdtable[mdtc].label, "(S, %d)", ssntc);
        ssntc++;
        strcpy(opcode, strtok(NULL, " "));
    }
    // If Input is "&" -> Macro Defination Table to be Updated
    else if (label[0] == '&')
    {
        int ev = get_EV_idx(label + 1);
        sprintf(mdtable[mdtc].label, "(E, %d)", ev);
        strcpy(opcode, strtok(NULL, " "));
    }
    else
    {
        strcpy(opcode, label);
        strcpy(mdtable[mdtc].label, "");
    }

    strcpy(mdtable[mdtc].opcode, opcode);
    strcpy(operands, strtok(NULL, ""));
    operands[strlen(operands) - 1] = '\0';

    // LCL -> Local EV & GBL -> Global EV {Event Table to be Updated}
    if (strcmp(opcode, "LCL") == 0 || strcmp(opcode, "GBL") == 0)
    {
        evntab[evntc].index = evntc;
        strcpy(evntab[evntc].name, operands + 1);
        sprintf(mdtable[mdtc].operands, "(E, %d)", evntc);
        evntc++;
    }
    else
    {
        int i = 0;
        while (operands[i] != '\0')
        {
            if (operands[i] == '&')
            {
                i = filter_inp(temp, operands, i + 1);
                int param = get_Parameter_idx(temp);
                int ev = get_EV_idx(temp);
                if (param >= 0)
                {
                    sprintf(temp, "(P, %d)", param);
                    strcat(mdtable[mdtc].operands, temp);
                }
                else if (ev >= 0)
                {
                    sprintf(temp, "(E, %d)", ev);
                    strcat(mdtable[mdtc].operands, temp);
                }
                else
                {
                    strcat(mdtable[mdtc].operands, temp);
                }
            }
            else if (operands[i] == '.')
            {
                i = filter_inp(temp, operands, i);
                int ss = get_SS_idx(temp);
                sprintf(temp, "(S, %d)", ss);
                strcat(mdtable[mdtc].operands, temp);
            }
            else
            {
                sprintf(mdtable[mdtc].operands, "%s%c", mdtable[mdtc].operands,
operands[i++]);
            }
        }
    }

    mdtable[mdtc].index = mdtc;
    mdtc++;
}
```

Output



```
MNT (Macro Name Table)
Name            #PP     #KP     #EV     #MDTP   #KPDTP  #SSTP
CLEARMEM        2       1       0       0       0       0

PNTAB (Parameter Name Table)
Sr. No  Name
0       X
1       N
2       REG

EVNTAB (Expansion Time Variable Name Table)
Index   Name
0       M

SSNTAB (Sequencing Symbol Name Table)
Index   SS Name
0       .MORE

KPDTAB (Keyword Parameter Default Value Table)
Index   Paramter Name   Default Value
0       REG             AREG


MDTABLE (Macro Definition Table)
Sr. No  Label   Opcode  Operands
0               LCL     (E, 0)
1       (E, 0)  SET     0
2               MOVER   (P, 2), ='0'
3       (S, 0)  MOVEM   (P, 2), (P, 0) + (E, 0)
4       (E, 0)  SET     (E, 0)+1
5               IAF     ((E, 0) NE N) (S, 0)
6               MEND
```

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