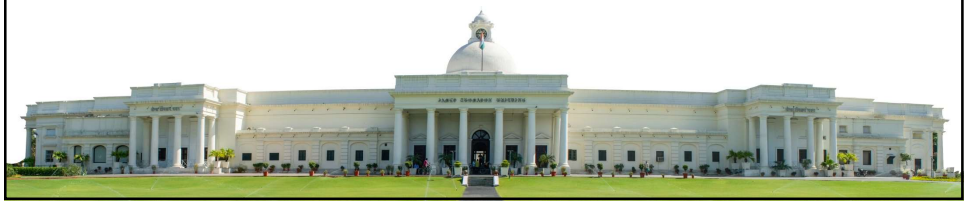
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

Macro Processors
Conditional Expansion



Conditional Macro Expansion

- Most macro processors can modify the sequence of statements generated for a macro expansion depending on the arguments in invocation
- **Conditional macro expansion statements**
  - *IF-ELSE-ENDIF*
  - *WHILE-ENDW*
- Macro-time variables
  - any symbol that begins with the character & and that is not a macro parameter
  - macro-time variables are initialized to 0
  - macro-time variables can be changed with their values using SET

```
&EORCK    SET    1
```

```
25    RDBUFF    MACRO    &INDEV,&BUFADR,&RECLTH,&EOR,&MAXLTH
26              IF       (&EOR NE '')
27    &EORCK    SET      1
28              ENDIF
30              CLEAR    X                 CLEAR LOOP COUNTER
35              CLEAR    A
38              IF       (&EORCK EQ 1)
40              LDCH     =X'&EOR'          SET EOR CHARACTER
42              RMO      A,S
43              ENDIF
44              IF       (&MAXLTH EQ '')
45              +LDT     #4096             SET MAX LENGTH = 4096
46              ELSE
47              +LDT     #&MAXLTH          SET MAXIMUM RECORD LENGTH
48              ENDIF
50    $LOOP     TD       =X'&INDEV'        TEST INPUT DEVICE
55              JEQ      $LOOP             LOOP UNTIL READY
60              RD       =X'&INDEV'        READ CHARACTER INTO REG A
63              IF       (&EORCK EQ 1)
65              COMPR    A,S               TEST FOR END OF RECORD
70              JEQ      $EXIT             EXIT LOOP IF EOR
73              ENDIF
75              STCH     &BUFADR,X         STORE CHARACTER IN BUFFER
80              TIXR     T                 LOOP UNLESS MAXIMUM LENGTH
85              JLT      $LOOP               HAS BEEN REACHED
90    $EXIT     STX      &RECLTH           SAVE RECORD LENGTH
95              MEND
```

RDBUFF F3, BUF, RECL, 04, 2048

```
25    RDBUFF    MACRO    &INDEV,&BUFADR,&RECLTH,&EOR,&MAXLTH
26              IF       (&EOR NE '')
27    &EORCK    SET      1
28              ENDIF
30              CLEAR    X
35              CLEAR    A
38              IF       (&EORCK EQ 1)
40              LDCH     =X'&EOR'
42              RMO      A,S
43              ENDIF
44              IF       (&MAXLTH EQ '')
45              +LDT     #4096
46              ELSE
47              +LDT     #&MAXLTH
48              ENDIF
50    $LOOP     TD       =X'&INDEV'
55              JEQ      $LOOP
60              RD       =X'&INDEV'
63              IF       (&EORCK EQ 1)
65              COMPR    A,S
70              JEQ      $EXIT
73              ENDIF
75              STCH     &BUFADR,X         STORE CHARACTER IN BUFFER
80              TIXR     T                 LOOP UNLESS MAXIMUM LENGTH
85              JLT      $LOOP               HAS BEEN REACHED
90    $EXIT     STX      &RECLTH           SAVE RECORD LENGTH
95              MEND
```

RDBUFF F3, BUF, RECL, 04, 2048

```
30              CLEAR    X
35              CLEAR    A
40              LDCH     =X'04'
42              RMO      A,S
47              +LDT     #2048
50    $AALOOP   TD       =X'F3'
55              JEQ      $AALOOP
60              RD       =X'F3'
65              COMPR    A,S
70              JEQ      $AAEXIT
75              STCH     BUF,X
80              TIXR     T
85              JLT      $AALOOP
90    $AAEXIT   STX      RECL
```

```
25    RDBUFF    MACRO   &INDEV,&BUFADR,&RECLTH,&EOR,&MAXLTH
26              IF      (&EOR NE '')
27    &EORCK    SET     1
28              ENDIF
30              CLEAR   X               CLEAR LOOP COUNTER
35              CLEAR   A
38              IF      (&EORCK EQ 1)
40              LDCH    =X'&EOR'
42              RMO     A,S
43              ENDIF
44              IF      (&MAXLTH EQ '')
45              +LDT    #4096
46              ELSE
47              +LDT    #&MAXLTH
48              ENDIF
50    $LOOP     TD      =X'&INDEV'
55              JEQ     $LOOP
60              RD      =X'&INDEV'
63              IF      (&EORCK EQ 1)
65              COMPR   A,S
70              JEQ     $EXIT
73              ENDIF
75              STCH    &BUFADR,X       STORE CHARACTER IN BUFFER
80              TIXR    T               LOOP UNLESS MAXIMUM LENGTH
85              JLT     $LOOP             HAS BEEN REACHED
90    $EXIT     STX     &RECLTH         SAVE RECORD LENGTH
95              MEND
```

RDBUFF 0E, BUFFER, LENGTH, , 80

```
30              CLEAR   X
35              CLEAR   A
47              +LDT    #80
50    $ABLOOP   TD      =X'0E'
55              JEQ     $ABLOOP
60              RD      =X'0E'
75              STCH    BUFFER,
80              TIXR    T
87              JLT     $ABLOOP
90    $ABEXIT   STX     LENGTH
```

- Testing of Boolean expressions in IF statement occurs at the time of macro expansion
- Same applies to the assignment of values to macro-time variables

```
25    RDBUFF    MACRO    &INDEV,&BUFADR,&RECLTH,&EOR,&MAXLTH
26              IF       (&EOR NE '')
27    &EORCK    SET      1
28              ENDIF
30              CLEAR    X
35              CLEAR    A
38              IF       (&EORCK EQ 1)
40              LDCH     =X'&EOR'
42              RMO      A,S
43              ENDIF
44              IF       (&MAXLTH EQ '')
45              +LDT     #4096
46              ELSE
47              +LDT     #&MAXLTH
48              ENDIF
50    $LOOP     TD       =X'&INDEV'
55              JEQ      $LOOP
60              RD       =X'&INDEV'
63              IF       (&EORCK EQ 1)
65              COMPR    A,S
70              JEQ      $EXIT
73              ENDIF
75              STCH     &BUFADR,X
80              TIXR     T
85              JLT      $LOOP
90    $EXIT     STX      &RECLTH
95              MEND
```

(a)

```
RDBUFF    F1, BUFF, RLENG, 04

30              CLEAR    X
35              CLEAR    A
40              LDCH     =X'04'
42              RMO      A,S
45              +LDT     #4096
50    $ACLOOP   TD       =X'F1'
55              JEQ      $ACLOOP
60              RD       =X'F1'
65              COMPR    A,S
70              JEQ      $ACEXIT
75              STCH     BUFF,X
80              TIXR     T
85              JLT      $ACLOOP
90    $ACEXIT   STX      RLENG

STORE CHARACTER IN BUFFER
LOOP UNLESS MAXIMUM LENGTH
  HAS BEEN REACHED
SAVE RECORD LENGTH
```

(d)

Conditional Macro Expansion (Cont.)

- Macro-time looping statement
  - WHILE-ENDW
- Macro processor function
  - %NITEMS: THE NUMBER OF MEMBERS IN AN ARGUMENT LIST

```
25  rdbuff      macro   &indev,  &bufadr,  &reclth, &eor
27  &eorct      set     %nitems(&eor)
30              clear   x
35              clear   a
45              +ldt    #4096
50  $loop       td      =x'&indev'
55              jeq     $loop
60              rd      =x'&indev'
63  &ctr        set     1
64              while   (&ctr  le  &eorct)
65              comp    =x'0000&eor[&ctr]
70              jeq     $exit
71  &ctr        set     &ctr +1
73              endw
75              stch    &bufadr, x
80              tixr    t
85              jlt     $loop
90  $exit       stx     &reclth
100             mend
```

```
RDBUFF      F2, BUF,
        LENGTH, (00, 03, 04)
```

ANSI C Macro Language

```
#define NULL 0
```

- Macros with parameters

```
#define ABSDIF(X, Y)  ((X) > (Y) ? (X) – (Y) : (Y) – (X))
ABSDIF(I +1, J – 5)
#define ABSDIF(X, Y) X > Y ? X – Y : Y – X
ABSDIF(3 + 1, 10 – 8)
```

- Parameter substitution is not performed within quoted strings

```
#define DISPLAY(EXPR)          printf("EXPR = %d\n", EXPR)
DISPLAY(I *J + 1)
```

ANSI C Macro Language (contd.)

#define DISPLAY(EXPR) printf(#EXPR "= %d\n", EXPR)

- Macro invocation within macro invocation

  DISPLAY(ABSDIF(3,8))

  After a macro is expanded, it is scanned again for macro definitions / invocations

- Conditional statements

```
#ifndef   BUFF_SIZE
#define   BUFF_SIZE   1024
#endif
```