

## **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,&BUFADI	R,&RECLTH,&EOR,&MAXLTH
26		TF	(&EOR NE '')	
27	&EORCK	SET	1	
28	933333	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	(&MAXL/TH EQ '	
45		+LDT	#4096	SET MAX LENGTH = 4096
46		ELSE		
47		+LDT	#AMAXI/TH	SET MAXIMUM RECORD LENGTH
48		END1F.		
50	\$LOOP	TD	=X,&INDEA,	TEST INPUT DEVICE
55		JEQ	\$LOOP	LOOP UNTIL READY
60		RD	=X,&INDEA,	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	ŞTX	&RECLTH	SAVE RECORD LENGTH
95		MEND	RDBU	FF F3, BUF, RECL, 04, 2048

25	RDBUFF	MACRO	&INDEV,&BUFAL	R,&RECL	TH,&EOR,&M	AXLIH	
26		TF	(&EOR NE '')				
27	&FORCK	SET	1 I	RDBUFF	F3,	BUF, REC	CL, 04, 2048
28		ENDIF					
30		CLEAR	X	30		CLEAR	x
35		CLEAR	A	35		CLEAR	A
38		IF	(&EORCK EQ 1)			LDCH	=X'04'
40		LDCH	=X'&EOR'	40			
42		RMO	A,S	42		RMO	A,S
43		ENDIF		47		+LDT	#2048
44		IF	(SMAXLTH EQ '	1)50	\$AALOOP	TD	=X'F3'
45		+LDT	#4096	55		JEQ	\$AALCOP
46		ELSE		60		RD	=X'F3'
47		+LDT	#AMAXI/TH	65		COMPR	A,S
48		END1F		70		JEO	SAAEXIT
50	\$LOOP	TD	=X'&INDEV'	75		STCH	BUF,X
55		JEQ	\$LOOP				T T
60		RD	=X'&INDEV'	80		TIXR	
63		IF	(&EORCK EQ 1)			JLT	\$AALOOP
65		COMPR	A,S	90	\$AAEXIT	STX	RECL
70		JEQ	\$EXIT				
73		ENDIF					
75		STCH	&BUFADR,X	STORE	CHARACTER	IN BUFF	ER
80		TIXR	T	LOOP !	UNLESS MAX	IMUM LEN	GTH
85		JLT	\$LCOP	HAS	BEEN REAC	HED	
90	\$EXIT	STX	&RECLTH	SAVE I	RECORD LEN	GTH	
95		MEND					
			(a)				

25	RDBUFF	MACRO	&INDEV,&BUFADR,&RECLTH,&EOR,&MAXLTH						
26		TF	(&EOR I	ΔE (()					
27	&FORCK	SET	1	RDBU	IFF	OF BU	FFFR IF	NGTH, , 80	
28		ENDIF		KDD	J1 1	ol, bo	TTER, EE	110111, , 00	
30		CLEAR	x		CLEAF	R LOOP COUN	TER		
35		CLEAR	A						
38		IF	(&EORCI	K EQ 1)					
40		LDCH	=X'&EOR	31 - 1199 11	30		CLEAR	х	
42		RMO	A,S		35		CLEAR	A	
43		ENDIF					+LDT	#80	
44		IF	(&MAXL/	TH EQ ''	) 47	4		(A. 1970) (1970)	
45		+LDT	#4096		50	\$ABLOOP	$\mathbf{T} \mathcal{D}$	=X'0E'	
46		ELSE			55		JEQ	\$ABLOOP	
47		+LDT	#&MAXI/TI	Ŧ	60		RD	=X'0E'	
48		END1F			75		STCH	BUFFER,	
50	\$LOOP	TD	=X'&IND	EV′	80		TIXR	т	
55		JEQ	\$LOOP		30 3000000		(50) 51 MAY (50) 1/2	27g	
60		RD	=X'&IND	EV′	87		JLT	\$ABLOOP	
63		IF	(&EORCI	K EQ 1)	90	\$ABEXIT	STX	LENGTH	
65		COMPR	A,S						
70		JEQ	\$EXIT						
73		ENDIF							
75		STCH	&BUFADI	R,X	STORE	E CHARACTER	IN BUFFI	⊴R	
80		TIXR	${f T}$		LOOP	UNLESS MAX	IMUM LENG	JTH	
85		JLT	\$LOOP		has been reached				
90	\$EXIT	STX	&RECLT!	H	SAVE	RECORD LEN	GTH		
95		MEND							

- 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	DDDLIEE		E1 DITE	E DI ENC	0.4		
28		ENDIF	RDBUFF		F1, BUFF, RLENG, 04					
30		CLEAR	X	30		CLEAR	X			
35		CLEAR	A	35		CLEAR	A			
38		IF	(&EORCK EQ 1)	40		LDCH	=X'04'			
40		LDCH	=X'&EOR'	42		RMO	A,S			
42		RMO	A,S	45		+LDT	#4096			
43		ENDIF		. 50	\$ACLOOP	TD	=X'F1'			
44		IF	(&MAXLTH EQ ''	55	Q110L001	JEO	SACLOOP			
45		+LDT	#4096	60		RD	=X'F1'			
46		ELSE		65		COMPR	A,S			
47		+LDT	#&MAXL/TH	70			\$ACEXIT			
48		END1F		487		JEQ GEGU				
50	\$LOOP	TD	=X'&INDEV'	75		STCH	BUFF,X			
55		JEQ	\$LOOP	80		TIXR	T			
60		RD	=X'&INDEV'	85		JLT	\$ACLOOP			
63		IF	(&EORCK EQ 1)	90	\$ACEXIT	STX	RLENG			
65		COMPR	A,S							
70		JEQ	\$EXIT					(d)		
73		ENDIF								
75		STCH	&BUFADR,X	STORE	CHARACT	er in bu	FFER			
80		TIXR	T	LOOP	UNLESS M	AXIMUM L	ENGTH			
85		JLT	\$LOOP	6,9750 (850/00)	BEEN RE					
90	\$EXIT	STX	&RECLTH	SAVE	RECORD L	ENGTH				
95		MEND								
			(a)							

## 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
                     %nitems(&eor)
              set
30
              clear
                     \mathbf{X}
35
              clear
45
                     #4096
              +ldt
50 $loop
                     =x'&indev'
             td
55
             jeq
                     $loop
60
              rd
                     =x'&indev'
63 &ctr
              set
              while (&ctr le &eorct)
64
65
              comp = x'0000\&eor[\&ctr]
70
                     $exit
             jeq
                                      RDBUFF
                                                    F2, BUF,
71 &ctr
              set
                     &ctr +1
                                            LENGTH, (00, 03, 04)
73
              endw
75
             stch
                     &bufadr, x
80
              tixr
85
                     $loop
             ilt
90 $exit
                     &reclth
              stx
100
```

## 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
```

```
manoj@manoj-VirtualBox: ~/CSN-252/macro Q
manoj@manoj-VirtualBox: ~/CSN-252/macro$ more ex2.c
#define ABSDIF(X, Y) X > Y ? X - Y : Y - X
#define DISPLAY(EXPR) printf("EXPR = %d\n", EXPR);
#define DISPLAY2(EXPR) printf(#EXPR "=%d\n", EXPR);

int main(){
  printf("%d\n", ABSDIF(3 + 1, 10 - 8));
  DISPLAY(I*J+1);
  DISPLAY(ABSDIF(3,8));
  DISPLAY(DISPLAY(K));
}
manoj@manoj-VirtualBox: ~/CSN-252/macro$ gcc -E ex2.c

int main(){
  printf("%d\n", 3 + 1 > 10 - 8 ? 3 + 1 - 10 - 8 : 10 - 8 - 3 + 1);
  printf("EXPR = %d\n", I*J+1);
  printf("EXPR = %d\n", I*J+1);
  printf("EXPR = %d\n", I*J+1);
  printf("EXPR = %d\n", I*J+1);
  printf("EXPR = %d\n", printf("EXPR = %d\n", K););
}
manoj@manoj-VirtualBox: ~/CSN-252/macro$
```