

הרצאה 7 פסיקות תוכנה / מלכודות Software Interrupts (Traps)

Edited by Tamer Salman 2008

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פסיקות תוכנה

• פסיקת תוכנה (מלכודת) הינה אירוע פנימי הגורם למעבד להפסיק את פעילותו ולבצע שגרת פסיקה מיוחדת.

• תנאי קבלה של מלכודת?

– מלכודת תמיד תתקבל.

• מלכודות

– IOT – Input output trap

– EMT – Emulated trap

– TRAP

– BPT – Break point trap

– T-bit – Trace bit trap

IV שימוש

20/22 טיפול בקלט/פלט

30/32 טיפול במערכת ההפעלה

34/36 טיפול בשגיאות

14/16 מעקב ו-debugging

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המשך

```

. = torg + 2000
main:  mov    pc, sp                ; STACK INIT
      tst    -(sp)
      clr    count
      mov    #101, @#tks          ; ENABLE KB INTERRUPTS
      mov    #100, @#cls          ; ENABLE CLOCK INTERRUPTS

      mov    #char, -(sp)         ; PUSH CHARACTER'S ADDRESS
                                      ; TO STACK
      iot                                ; CALL PRINT THROUGH IOT
      tst    (sp)+                ; REMOVE CHARACTER'S ADDRESS FROM STACK
w:     wait
      br    w
char:  .ascii <Q>                ; A CHARACTER TO BE PRINTED
.even
count: .blkw 1                    ; TIME OUT COUNTER

```

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המשך

```

echo:  clr    count                ; CLEAR THE MINUTE COUNTER
      mov    #tkb, -(sp)          ; SEND CHARACTER TO PRINTING
      iot                                ; CALL PRINT THROUGH IOT
      tst    (sp)+                ; REMOVE ADDRESS FROM STACK
      inc    @#tks                ; RE-ACTIVATE KEYBOARD
      rti

print: tstb   @#tps                ; IS PRINTER READY?
      bpl   print                ; IF NOT, CONTINUE POLLING
      movb  @4(sp), @#tpb         ; PRINT INPUT PARAMETER
      rti

```

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המשך

```

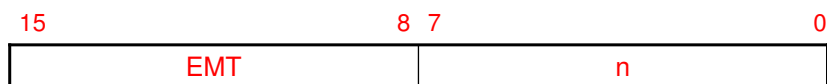
clock:  int    count           ; TIME GOES ON
        cmp    count, timeout  ; TIMEOUT?
        blt    endclk         ; IF NOT, DO NOTHING.
        clr    count          ; RESET TIMEOUT COUNTER
        mov    #bell, -(sp)    ; PUSH BELL TO STACK
        iot                    ; CALL PRINT THROUGH IOT
        tst    (sp)+          ; REMOVE ADDRESS FROM STACK
endclk: rti

timeout: .word 3000.           ; 50. * 60. CLOCK TICKS
bell:    .byte 7              ; ASCII CODE OF A BELL RING
    
```

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דוגמה EMT



```

. = torg + 30           ; EMT INTERRUPT VECTOR
. word emptrap, 340

. = torg + 2000        ; EMT TRAP HANDLER
emtrap: mov    (sp), -(sp) ; GET CALLER'S PC
        sub    #2, (sp)    ; CALCULATE EMT ADDRESS
        mov    @0(sp), (sp) ; GET EMT MACHINE CODE
        bic    #177400, (sp) ; GET SERVICE NUMBER
        asl    (sp)        ; CALCULATE SERVICE ADDRESS
        add    #emtable, (sp)
        mov    @0(sp), (sp)
        jmp    @(sp)+      ; JUMP TO SERVICE CODE
    
```

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המשך

```

emtable: .word emt00          ; ADDRESS OF SERVICE 0
         .word emt01          ; ADDRESS OF SERVICE 1
         .word emt02          ; ADDRESS OF SERVICE 2
         ...

emt00:   ...                  ; EMT SERVICE 0
         rti

emt01:   ...                  ; EMT SERVICE 1
         rti

emt02:   rti                  ; EMT SERVICE 2 – not defined.

. = torg + 5000                ; USER PROGRAM
         ...
         emt    1
         ...
    
```

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T-bit דוגמה

```

emt00:   bic    #20, 2(sp)    ; TURN T-BIT OFF IN CALLER'S PSW
         rti

emt01:   mov    #trace, @#14  ; SET T-BIT IV PC
         mov    #340, @#16    ; SET T-BIT IV PSW
         bis    #20, 2(sp)    ; TURN T-BIT ON IN CALLER'S PSW
         rti

. = torg + 4000                ; T-BIT TRAP HANDLER
trace:   mov    (sp), @tr_next ; SAVE PC IN TABLE
         add    #2, tr_next    ; INCREMENT TABLE POINTER
         rtt

tr_next: .word 10000          ; TABLE POINTER
    
```

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המשך

```
. = torg + 5000  
trace_off = 0  
trace_on = 1
```

```
main:  mov    #2000, sp    ; INITIALIZE STACK  
      ...  
      emt   trace_on     ; TURN TRACE ON  
  
      ...                ; THIS PORTION OF THE PROGRAM WILL  
      ...                ; BE TRACED  
  
      emt   trace_off    ; TURN TRACE OFF  
      ...  
      halt
```