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EXPERIMENT-10

Aim: Study of implementation of TSR:

Program 1: Active TSR using hot key combination.

Code:

;a TSR program
 ;the ALT-K key combination is activated.
 ;A hot key is composed of a key scan code and a code found in memory location 0000:0417.
 ;The keyboard generates type9 interrupt whenever a key is typed. When intercepted with the TSR handler, it reads the keyboard code directly from I/O port 60H, which returns the keyboard scan code.

```

.MODEL TINY
.386
.CODE
.STARTUP
JMP  INSTALL          ;install VEC9

HFLAG      DB      0          ;Hot-key detected
ADD9 DD     ?              ;old vector 9 address

KEY  DB     25H            ;scan code for K
HMASK DB     8             ;alternate key mask
MKEY DB     8              ;alternate key
SCRN DB     300 DUP (?)    ;screen buffer
MES1 DB     'TSR IS ACTIVE'

VEC9 PROC FAR              ;keyboard intercept

```

```

    STI                ;enable interrupts
    PUSH AX            ;save AX
    IN AL,60H          ;get scan code
    CMP AL,CS:KEY      ;test for K
    JNE VEC91          ;no hot-key
    MOV AX,0           ;address segment 0000
    PUSH DS            ;save DS
    MOV DS,AX
    MOV AL,DS:[417H]    ;get shift/alternate data
    POP DS
    AND AL,CS:HMASK     ;isolate alternate key
    CMP AL,CS:MKEY      ;test for alternate key
    JE VEC93           ;if hot-key found
VEC91:
    POP AX
    JMP CS:ADD9         ;do normal interrupt
VEC93:                ;if hot-key pressed
    CLI                ;interrupts off
    IN AL,61H          ;clear keyboard and
    OR AL,80H          ;throw away hot key
    OUT 61H,AL
    AND AL,7FH
    OUT 61H,AL
    MOV AL,20H         ;reset keyboard interrupt
    OUT 20H,AL
    STI                ;enable interrupts
    MOV CS:HFLAG,1     ;indicate hot-key pressed
push cx

push di
push si
push ds
push es
cld
mov ax,cs
mov es,ax
mov ax,0b800h
mov ds,ax
mov cx,160
mov di,offset scrn
mov si,0
rep movsb
push ds

```

```

    push es
    pop ds
    pop es
    mov di,80
    mov si,offset mes1
    mov ah,0fh
    mov cx,13
vec95: lodsb
    stosw
    loop vec95
    pop es
    pop ds
    pop si
    pop di

    pop cx
    POP    AX
    IRET

VEC9 ENDP

```

```

INSTALL:                                     ;install VEC9

        MOV     AX,CS                       ;load DS
        MOV     DS,AX

        MOV     AX,3509H                   ;get current vector 9
        INT     21H                         ;and save it
        MOV     WORD PTR ADD9,BX
        MOV     WORD PTR ADD9+2,ES

        MOV     AX,2509H
        MOV     DX,OFFSET VEC9             ;address interrupt procedure
        INT     21H                         ;install vector 9

        MOV     DX,OFFSET INSTALL           ;find paragraphs
        SHR     DX,4
        INC     DX

        MOV     AX,3100H                   ;set as a TSR
        INT     21H
        END

```

Compilation:

```
DOS
BOX DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Pro... — □ ×
A:\>TASM TSR_KEY.ASM
Turbo Assembler Version 3.0 Copyright (c) 1988, 1991 Borland International

Assembling file:   TSR_KEY.ASM
Error messages:   None
Warning messages: None
Passes:           1
Remaining memory: 474k

A:\>TLINK TSR_KEY.OBJ
Turbo Link Version 3.0 Copyright (c) 1987, 1990 Borland International
Warning: No stack

A:\>TASM TSR_KEY
Turbo Assembler Version 3.0 Copyright (c) 1988, 1991 Borland International

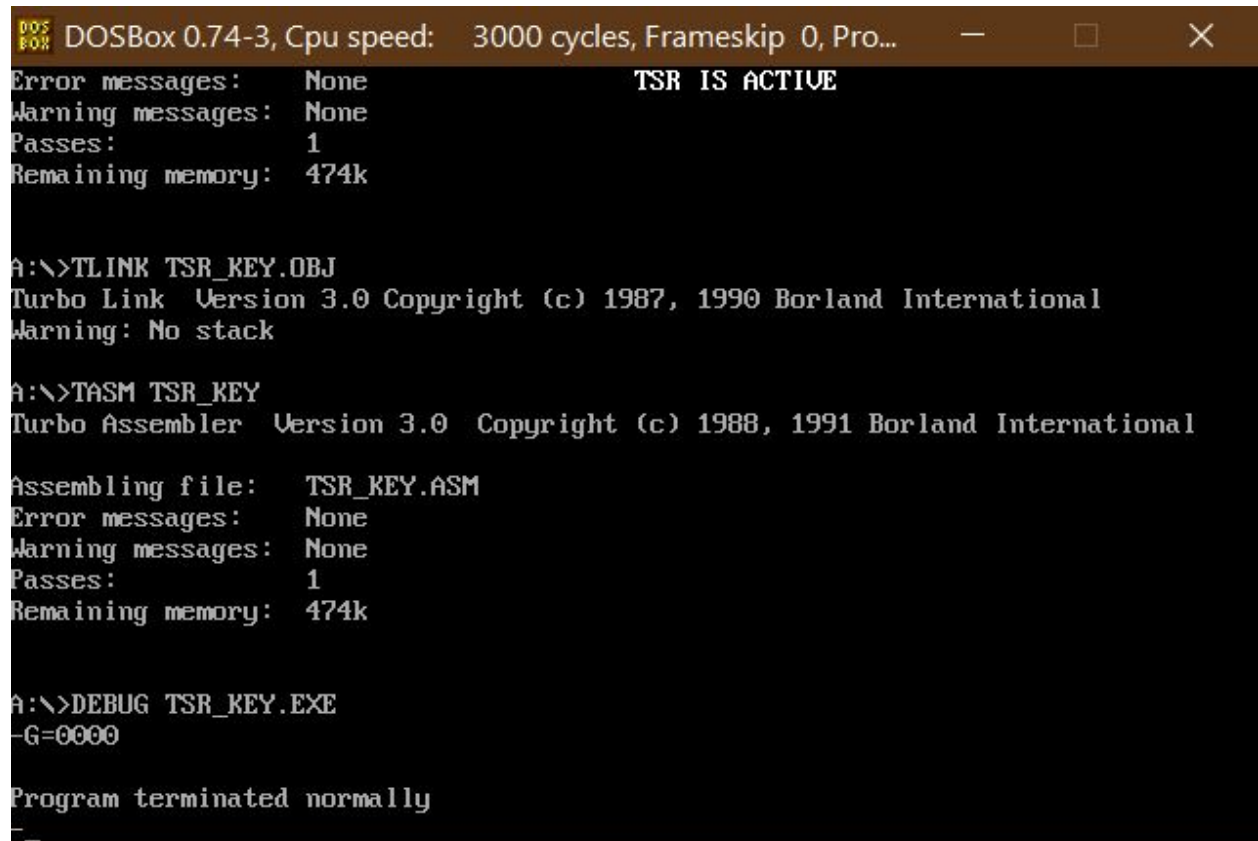
Assembling file:   TSR_KEY.ASM
Error messages:   None
Warning messages: None
Passes:           1
Remaining memory: 474k

A:\>_

A:\>DEBUG TSR_KEY.EXE
-G=0000

Program terminated normally
_
```

Output: //After Pressing Ctrl+Alt

A screenshot of a DOSBox window titled "DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Pro...". The window has a dark background with white text. The text shows the execution of a program named TSR_KEY. It starts with status information: "Error messages: None", "Warning messages: None", "Passes: 1", and "Remaining memory: 474k". Then, it shows the command "A:\>TLINK TSR_KEY.OBJ" followed by "Turbo Link Version 3.0 Copyright (c) 1987, 1990 Borland International" and a "Warning: No stack". Next is "A:\>TASM TSR_KEY" followed by "Turbo Assembler Version 3.0 Copyright (c) 1988, 1991 Borland International". This is followed by assembly details: "Assembling file: TSR_KEY.ASM", "Error messages: None", "Warning messages: None", "Passes: 1", and "Remaining memory: 474k". Then, the command "A:\>DEBUG TSR_KEY.EXE" is shown, followed by "-G=0000". Finally, it says "Program terminated normally" and ends with a cursor on a new line.

```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Pro...
Error messages:      None                TSR IS ACTIVE
Warning messages:   None
Passes:             1
Remaining memory:   474k

A:\>TLINK TSR_KEY.OBJ
Turbo Link  Version 3.0 Copyright (c) 1987, 1990 Borland International
Warning: No stack

A:\>TASM TSR_KEY
Turbo Assembler  Version 3.0 Copyright (c) 1988, 1991 Borland International

Assembling file:   TSR_KEY.ASM
Error messages:    None
Warning messages:  None
Passes:            1
Remaining memory:  474k

A:\>DEBUG TSR_KEY.EXE
-G=0000

Program terminated normally
_
```

Program 2: Example of Active and Passive TSR - Screensaver.

Code:

;Write a TSR program in 8086 ALP to implement Screen Saver. Screen Saver should get
;activated if the keyboard is idle for 7 seconds. Access the video RAM directly in your routine.
;[http://books.google.co.in/books?id=zWrZY1OgTPsC&pg=PA283&lpg=PA283&dq=tsr+program;
+in+8086+with+hot+key+combination&source=bl&ots=9A_74oJXRL&sig=iqn5tQUedewU44M8
YPnDPxMP6bk&hl=en&sa=X&ei=F-b6U_zHII2jugTR84HABw&ved=0CBwQ6AEwAA#v=onepag
e&q=tsr%20program%20in%208086%20with%20hot%20key%20combination&f=false](http://books.google.co.in/books?id=zWrZY1OgTPsC&pg=PA283&lpg=PA283&dq=tsr+program;+in+8086+with+hot+key+combination&source=bl&ots=9A_74oJXRL&sig=iqn5tQUedewU44M8YPnDPxMP6bk&hl=en&sa=X&ei=F-b6U_zHII2jugTR84HABw&ved=0CBwQ6AEwAA#v=onepage&q=tsr%20program%20in%208086%20with%20hot%20key%20combination&f=false)

```
CODE SEGMENT
    ASSUME CS:CODE,DS:CODE,ES:CODE
    ORG 100H
START : JMP BEGIN
    TIMER_IP DW ?
    TIMER_CS DW ?
    KB_IP DW ?
    KB_CS DW ?
    FLAG DB 0
    CNT DB 180
    BUFFER DW 2000 DUP(0)
TIMER:
    PUSH AX
    PUSH BX
    PUSH CX
    PUSH DX
    PUSH SI
    PUSH DI
    PUSH DS
    PUSH ES

    MOV AX,CS
    MOV DS,AX
    MOV ES,AX

    CMP FLAG,00H
    JNE TIMER_END
    DEC CNT
    JNE TIMER_END

    CLD
    MOV AX,0B800H
    MOV DS,AX
    MOV SI,0000H
    MOV DI,OFFSET BUFFER
    MOV CX,2000
    REP MOVSW

    MOV AX,0B800H
    MOV ES,AX
    MOV DI,0000H
    MOV AL,48
    MOV AH,89
```

```
MOV CX,2000
REP STOSW
```

```
MOV CS:FLAG,01H
TIMER_END:
POP ES
POP DS
POP DI
POP SI
POP DX
POP CX
POP BX
POP AX
JMP DWORD PTR CS:TIMER_IP
KB:
```

```
PUSH AX
PUSH BX
PUSH CX
PUSH DX
PUSH SI
PUSH DI
PUSH DS
PUSH ES
```

```
MOV AX,CS
MOV DS,AX
MOV ES,AX
```

```
MOV CNT,180
CMP FLAG,01
JNE KB_END
```

```
CLD
MOV AX,0B800H
MOV ES,AX
MOV SI,OFFSET BUFFER
MOV DI,0000H
MOV CX,2000
REP MOVSW
```

```
MOV FLAG,00H
KB_END :
POP ES
POP DS
```

```
POP DI
POP SI
POP DX
POP CX
POP BX
POP AX
JMP DWORD PTR CS:KB_IP
```

BEGIN:

```
MOV AX,CS
MOV DS,AX
MOV ES,AX
```

```
MOV AH,35H
MOV AL,08H
INT 21H
```

```
MOV TIMER_IP,BX
MOV TIMER_CS,ES
```

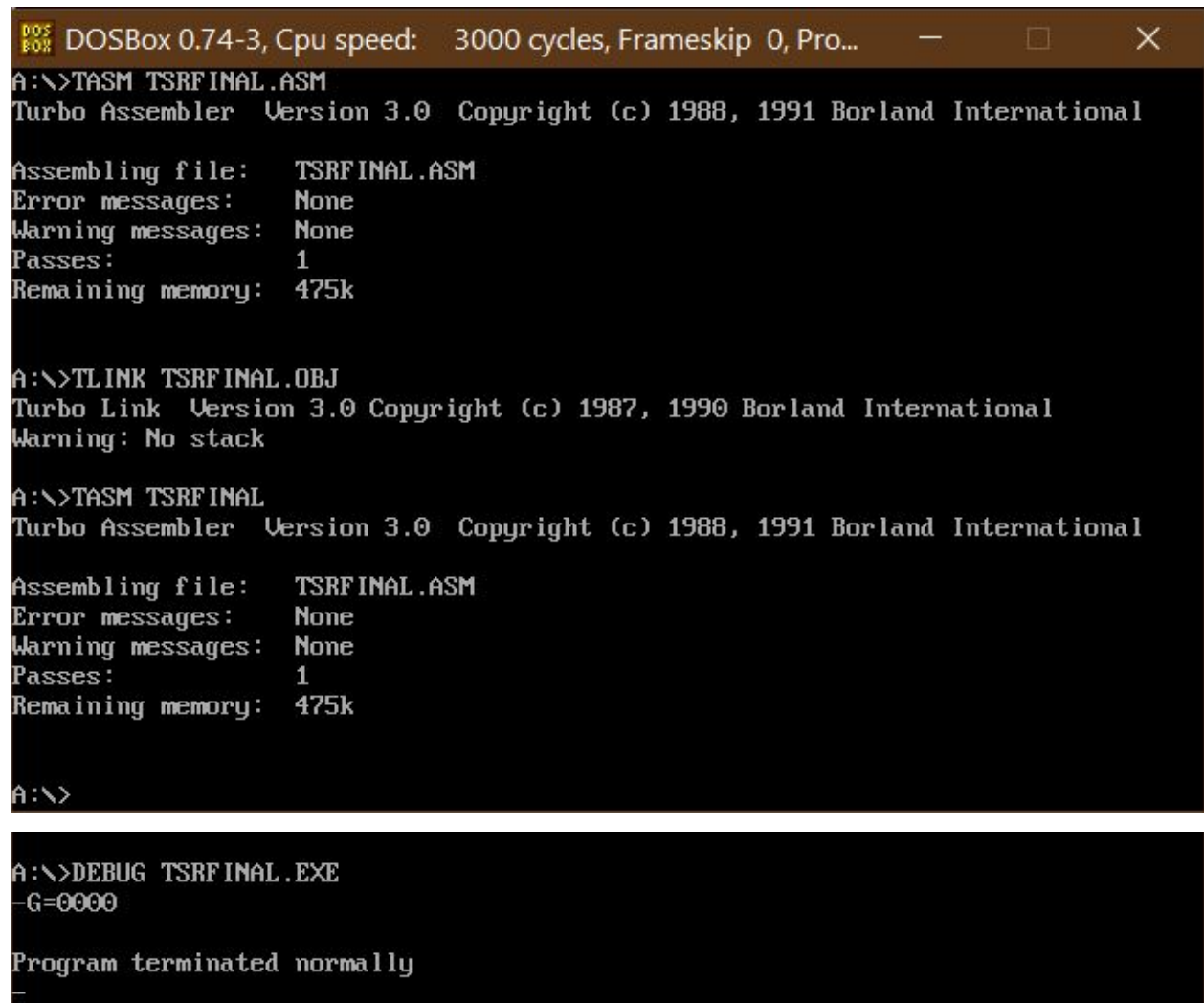
```
MOV AH,35H
MOV AL,09H
INT 21H
```

```
MOV KB_IP,BX
MOV KB_CS,ES
```

```
MOV AH,25H
MOV AL,08H
MOV DX,OFFSET TIMER
INT 21H
MOV AH,25H
MOV AL,09H
MOV DX,OFFSET KB
INT 21H
MOV AH,31H
MOV DX,OFFSET BEGIN
MOV CL,04H
SHR DX,CL
INC DX
INT 21H
```

```
CODE ENDS
END START
```


Compilation and Debugging:



```
DOSBox 0.74-3, Cpu speed: 3000 cycles, Frameskip 0, Pro...
A:\>TASM TSRFINAL.ASM
Turbo Assembler Version 3.0 Copyright (c) 1988, 1991 Borland International

Assembling file:   TSRFINAL.ASM
Error messages:    None
Warning messages:  None
Passes:            1
Remaining memory:  475k

A:\>TLINK TSRFINAL.OBJ
Turbo Link Version 3.0 Copyright (c) 1987, 1990 Borland International
Warning: No stack

A:\>TASM TSRFINAL
Turbo Assembler Version 3.0 Copyright (c) 1988, 1991 Borland International

Assembling file:   TSRFINAL.ASM
Error messages:    None
Warning messages:  None
Passes:            1
Remaining memory:  475k

A:\>

A:\>DEBUG TSRFINAL.EXE
-G=0000

Program terminated normally
_
```

Output://after 7/8 seconds:

