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<u>ENROLLMENT NO</u>.- 200280111051

<u>BATCH</u>- A2, 5TH SEM

EXERCISE 3

QUESTION 1

1. Give the register value for each of the following instructions after it is executed. Assume R0=0x4545, R1=0x5454 and R2=0xFF00.

a) AND R3, R2, R0

b) AND R3, R2, R2

c) AND R3, R0, #0xFF

d) ORR R3, R0, #0x0F

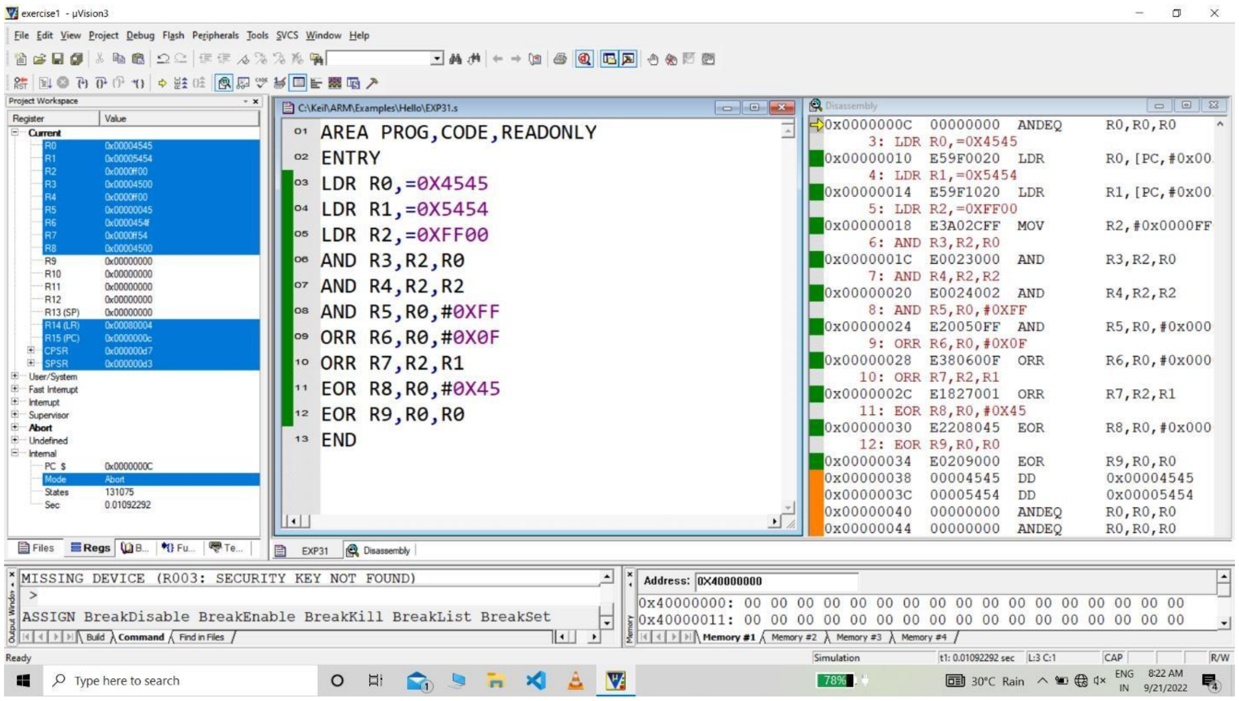
e) ORR R3, R2, R1

f) EOR R0, R0, #0x45
g) EOR R0, R0, R0

CODE:

```
AREA PROG,CODE,READONLY

ENTRY

LDR R0,=0X4545

LDR R1,=0X5454

LDR R2,=0XFF00

AND R3,R2,R0

AND R4,R2,R2

AND R5,R0,#0XFF

ORR R6,R0,#0X0F

ORR R7,R2,R1

EOR R8,R0,#0X45

EOR R9,R0,R0

END
```

OUTPUT:



```
AREA PROG,CODE,READONLY
ENTRY
LDR R0,=0X4545
LDR R1,=0X5454
LDR R2,=0XFF00
AND R3,R2,R0
AND R4,R2,R2
AND R5,R0,#0XFF
ORR R6,R0,#0X0F
ORR R7,R2,R1
EOR R8,R0,#0X45
EOR R9,R0,R0
END
```

Register	Value
R0	0x00004545
R1	0x00005454
R2	0x0000ff00
R3	0x00004500
R4	0x0000ff00
R5	0x00000045
R6	0x0000454f
R7	0x0000ff54
R8	0x00004500
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00080004
R15 (PC)	0x0000000c
CPSR	0x000000d7
SPSR	0x000000d3
PC $	0x0000000C
Mode	Abort
States	131075
Sec	0.01092292

```
0x0000000C  00000000  ANDEQ    R0,R0,R0
     3: LDR R0,=0X4545
0x00000010  E59F0020  LDR      R0,[PC,#0x00
     4: LDR R1,=0X5454
0x00000014  E59F1020  LDR      R1,[PC,#0x00
     5: LDR R2,=0XFF00
0x00000018  E3A02CFF  MOV      R2,#0x0000FF
     6: AND R3,R2,R0
0x0000001C  E0023000  AND      R3,R2,R0
     7: AND R4,R2,R2
0x00000020  E0024002  AND      R4,R2,R2
     8: AND R5,R0,#0XFF
0x00000024  E20050FF  AND      R5,R0,#0x000
     9: ORR R6,R0,#0X0F
0x00000028  E380600F  ORR      R6,R0,#0x000
    10: ORR R7,R2,R1
0x0000002C  E1827001  ORR      R7,R2,R1
    11: EOR R8,R0,#0X45
0x00000030  E2208045  EOR      R8,R0,#0x000
    12: EOR R9,R0,R0
0x00000034  E0209000  EOR      R9,R0,R0
0x00000038  00004545  DD       0x00004545
0x0000003C  00005454  DD       0x00005454
0x00000040  00000000  ANDEQ    R0,R0,R0
0x00000044  00000000  ANDEQ    R0,R0,R0
```

```
MISSING DEVICE (R003: SECURITY KEY NOT FOUND)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet
```

```
Address: 0X40000000
0x40000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x40000011: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

QUESTION 2

Write an instruction that sets bit 6 of R1 without affecting other bits.

CODE:

AREA LDCE,CODE,READONLY

ENTRY

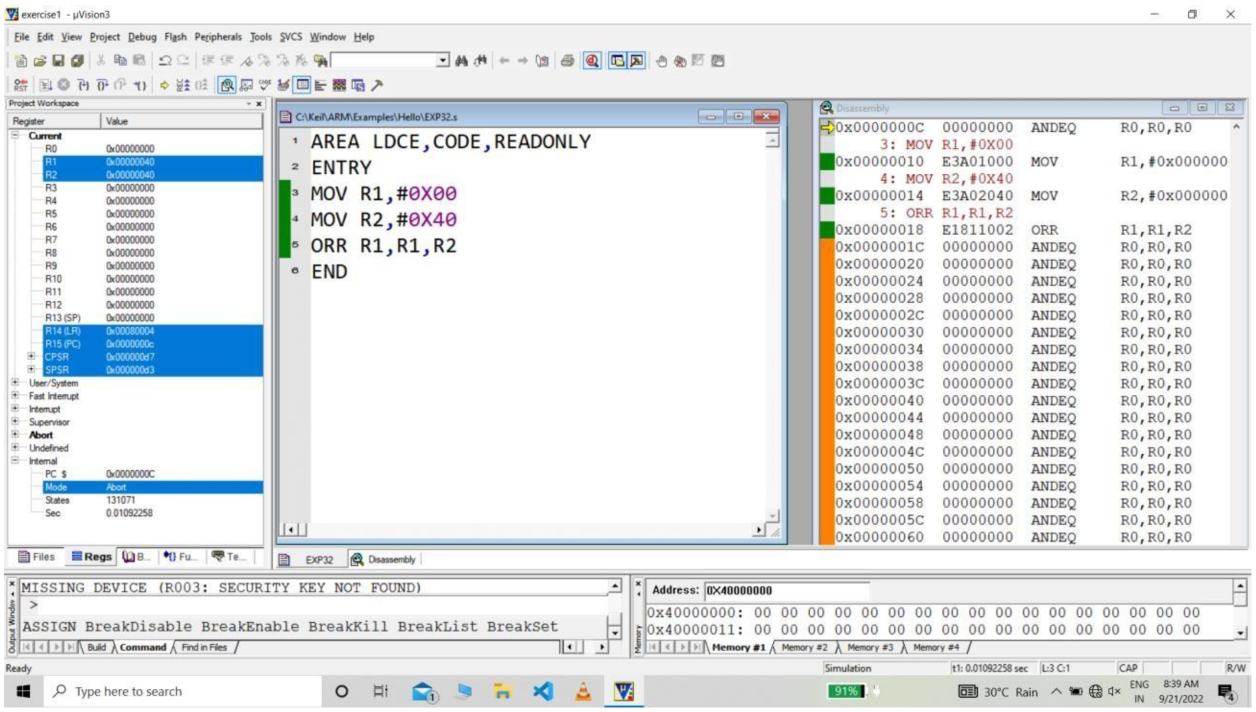
MOV R1,#0X00

MOV R2,#0X40

ORR R1,R1,R2

END

OUTPUT:



```
AREA LDCE,CODE,READONLY
ENTRY
MOV R1,#0X00
MOV R2,#0X40
ORR R1,R1,R2
END
```

Register	Value
Current	
R0	0x00000000
R1	0x00000040
R2	0x00000040
R3	0x00000000
R4	0x00000000
R5	0x00000000
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00080004
R15 (PC)	0x0000000c
CPSR	0x000000d7
SPSR	0x000000d3
User/System	
Fast Interrupt	
Interrupt	
Supervisor	
Abort	
Undefined	
Internal	
PC $	0x0000000C
Mode	Abort
States	131071
Sec	0.01092258

```
0x0000000C  00000000  ANDEQ     R0,R0,R0
       3: MOV R1,#0X00
0x00000010  E3A01000  MOV       R1,#0x000000
       4: MOV R2,#0X40
0x00000014  E3A02040  MOV       R2,#0x000000
       5: ORR R1,R1,R2
0x00000018  E1811002  ORR       R1,R1,R2
0x0000001C  00000000  ANDEQ     R0,R0,R0
0x00000020  00000000  ANDEQ     R0,R0,R0
0x00000024  00000000  ANDEQ     R0,R0,R0
0x00000028  00000000  ANDEQ     R0,R0,R0
0x0000002C  00000000  ANDEQ     R0,R0,R0
0x00000030  00000000  ANDEQ     R0,R0,R0
0x00000034  00000000  ANDEQ     R0,R0,R0
0x00000038  00000000  ANDEQ     R0,R0,R0
0x0000003C  00000000  ANDEQ     R0,R0,R0
0x00000040  00000000  ANDEQ     R0,R0,R0
0x00000044  00000000  ANDEQ     R0,R0,R0
0x00000048  00000000  ANDEQ     R0,R0,R0
0x0000004C  00000000  ANDEQ     R0,R0,R0
0x00000050  00000000  ANDEQ     R0,R0,R0
0x00000054  00000000  ANDEQ     R0,R0,R0
0x00000058  00000000  ANDEQ     R0,R0,R0
0x0000005C  00000000  ANDEQ     R0,R0,R0
0x00000060  00000000  ANDEQ     R0,R0,R0
```

```
MISSING DEVICE (R003: SECURITY KEY NOT FOUND)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet
```

```
Address: 0X40000000
0x40000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x40000011: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

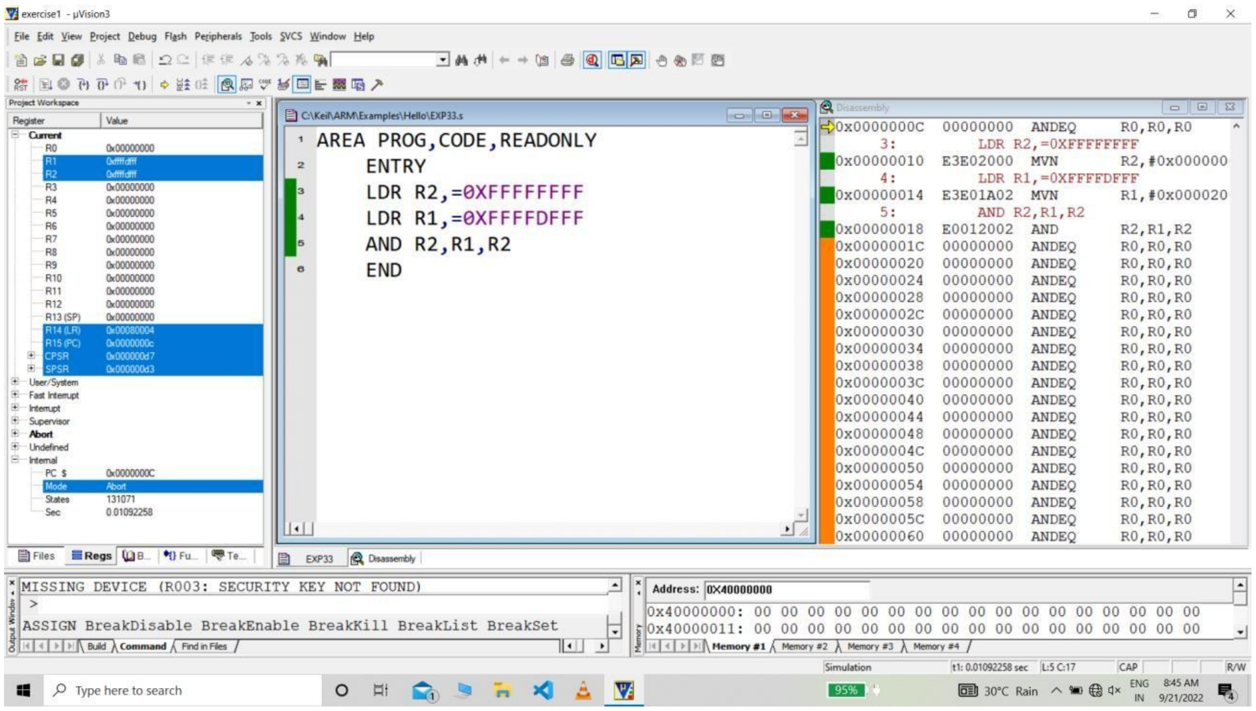
QUESTION 3

Write an instruction that clear bit 13 of R2 without affecting other bits.

CODE:

```
AREA PROG,CODE,READONLY
        ENTRY
        LDR  R2,=0XFFFFFFFF
        LDR R1,=0XFFFFDFFF
        AND R2,R1,R2
        END
```

OUTPUT:



exercise1 - µVision3

```
Register        Value
Current
  R0            0x00000000
  R1            0xffffdfff
  R2            0xffffdfff
  R3            0x00000000
  R4            0x00000000
  R5            0x00000000
  R6            0x00000000
  R7            0x00000000
  R8            0x00000000
  R9            0x00000000
  R10           0x00000000
  R11           0x00000000
  R12           0x00000000
  R13 (SP)      0x00000000
  R14 (LR)      0x00080004
  R15 (PC)      0x0000000c
  CPSR          0x000000d7
  SPSR          0x000000d3
User/System
Fast Interrupt
Interrupt
Supervisor
Abort
Undefined
Internal
  PC  $         0x0000000C
  Mode          Abort
  States        131071
  Sec           0.01092258
```

C:\Keil\ARM\Examples\Hello\EXP33.s

```
AREA PROG,CODE,READONLY
     ENTRY
     LDR R2,=0XFFFFFFFF
     LDR R1,=0XFFFFDFFF
     AND R2,R1,R2
     END
```

Disassembly

```
0x0000000C  00000000  ANDEQ     R0,R0,R0
     3:          LDR R2,=0XFFFFFFFF
0x00000010  E3E02000  MVN       R2,#0x000000
     4:          LDR R1,=0XFFFFDFFF
0x00000014  E3E01A02  MVN       R1,#0x000020
     5:          AND R2,R1,R2
0x00000018  E0012002  AND       R2,R1,R2
0x0000001C  00000000  ANDEQ     R0,R0,R0
0x00000020  00000000  ANDEQ     R0,R0,R0
0x00000024  00000000  ANDEQ     R0,R0,R0
0x00000028  00000000  ANDEQ     R0,R0,R0
0x0000002C  00000000  ANDEQ     R0,R0,R0
0x00000030  00000000  ANDEQ     R0,R0,R0
0x00000034  00000000  ANDEQ     R0,R0,R0
0x00000038  00000000  ANDEQ     R0,R0,R0
0x0000003C  00000000  ANDEQ     R0,R0,R0
0x00000040  00000000  ANDEQ     R0,R0,R0
0x00000044  00000000  ANDEQ     R0,R0,R0
0x00000048  00000000  ANDEQ     R0,R0,R0
0x0000004C  00000000  ANDEQ     R0,R0,R0
0x00000050  00000000  ANDEQ     R0,R0,R0
0x00000054  00000000  ANDEQ     R0,R0,R0
0x00000058  00000000  ANDEQ     R0,R0,R0
0x0000005C  00000000  ANDEQ     R0,R0,R0
0x00000060  00000000  ANDEQ     R0,R0,R0
```

```
MISSING DEVICE (R003: SECURITY KEY NOT FOUND)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet
```

```
Address: 0X40000000
0x40000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x40000011: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Simulation   t1: 0.01092258 sec   L:5 C:17

QUESTION 4

Write a program to multiply the following values. (R1=0x5578, R2=0xaaa, R3=0xaabb987f, R4=0x12345678).

a) Multiply R1 and R2

b) Multiply R1 and R3

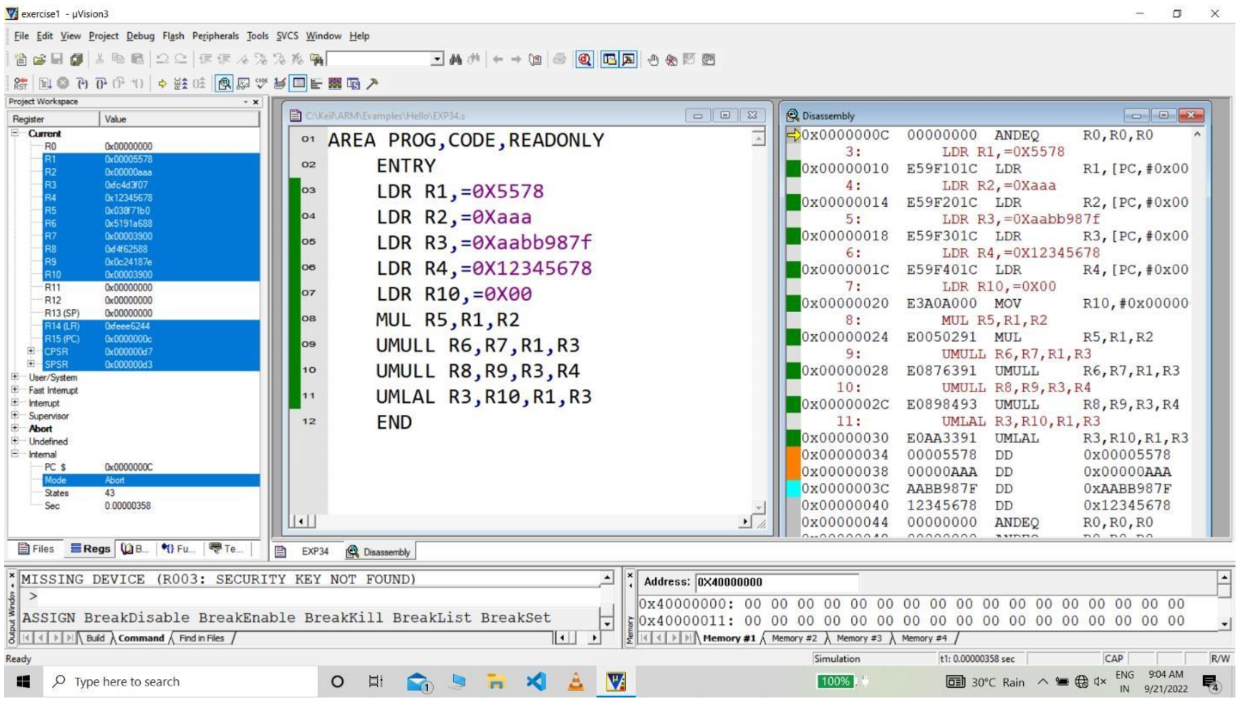
c) Multiply R3 and R4

d) Perform (R1 * R3 + R3)

CODE:

```
AREA PROG,CODE,READONLY
        ENTRY
        LDR R1,=0X5578
        LDR R2,=0Xaaa
        LDR R3,=0Xaabb987f
        LDR R4,=0X12345678
        LDR R10,=0X00
        MUL R5,R1,R2
        UMULL R6,R7,R1,R3
        UMULL R8,R9,R3,R4
        UMLAL R3,R10,R1,R3
        END
```

<u>OUTPUT:</u>



```
AREA PROG,CODE,READONLY
     ENTRY
     LDR R1,=0X5578
     LDR R2,=0Xaaa
     LDR R3,=0Xaabb987f
     LDR R4,=0X12345678
     LDR R10,=0X00
     MUL R5,R1,R2
     UMULL R6,R7,R1,R3
     UMULL R8,R9,R3,R4
     UMLAL R3,R10,R1,R3
     END
```

Register	Value
Current	
R0	0x00000000
R1	0x00005578
R2	0x00000aaa
R3	0xfc4d3f07
R4	0x12345678
R5	0x038f71b0
R6	0x5191a688
R7	0x00003900
R8	0xf4f62588
R9	0x0c24187e
R10	0x00003900
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0xfeee6244
R15 (PC)	0x0000000c
CPSR	0x000000d7
SPSR	0x000000d3
User/System	
Fast Interrupt	
Interrupt	
Supervisor	
Abort	
Undefined	
Internal	
PC $	0x0000000C
Mode	Abort
States	43
Sec	0.00000358

```
0x0000000C  00000000  ANDEQ     R0,R0,R0
     3:          LDR R1,=0X5578
0x00000010  E59F101C  LDR       R1,[PC,#0x00
     4:          LDR R2,=0Xaaa
0x00000014  E59F201C  LDR       R2,[PC,#0x00
     5:          LDR R3,=0Xaabb987f
0x00000018  E59F301C  LDR       R3,[PC,#0x00
     6:          LDR R4,=0X12345678
0x0000001C  E59F401C  LDR       R4,[PC,#0x00
     7:          LDR R10,=0X00
0x00000020  E3A0A000  MOV       R10,#0x00000
     8:          MUL R5,R1,R2
0x00000024  E0050291  MUL       R5,R1,R2
     9:          UMULL R6,R7,R1,R3
0x00000028  E0876391  UMULL     R6,R7,R1,R3
    10:          UMULL R8,R9,R3,R4
0x0000002C  E0898493  UMULL     R8,R9,R3,R4
    11:          UMLAL R3,R10,R1,R3
0x00000030  E0AA3391  UMLAL     R3,R10,R1,R3
0x00000034  00005578  DD        0x00005578
0x00000038  00000AAA  DD        0x00000AAA
0x0000003C  AABB987F  DD        0xAABB987F
0x00000040  12345678  DD        0x12345678
0x00000044  00000000  ANDEQ     R0,R0,R0
```

```
MISSING DEVICE (R003: SECURITY KEY NOT FOUND)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet
```

```
Address: 0X40000000
0x40000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x40000011: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

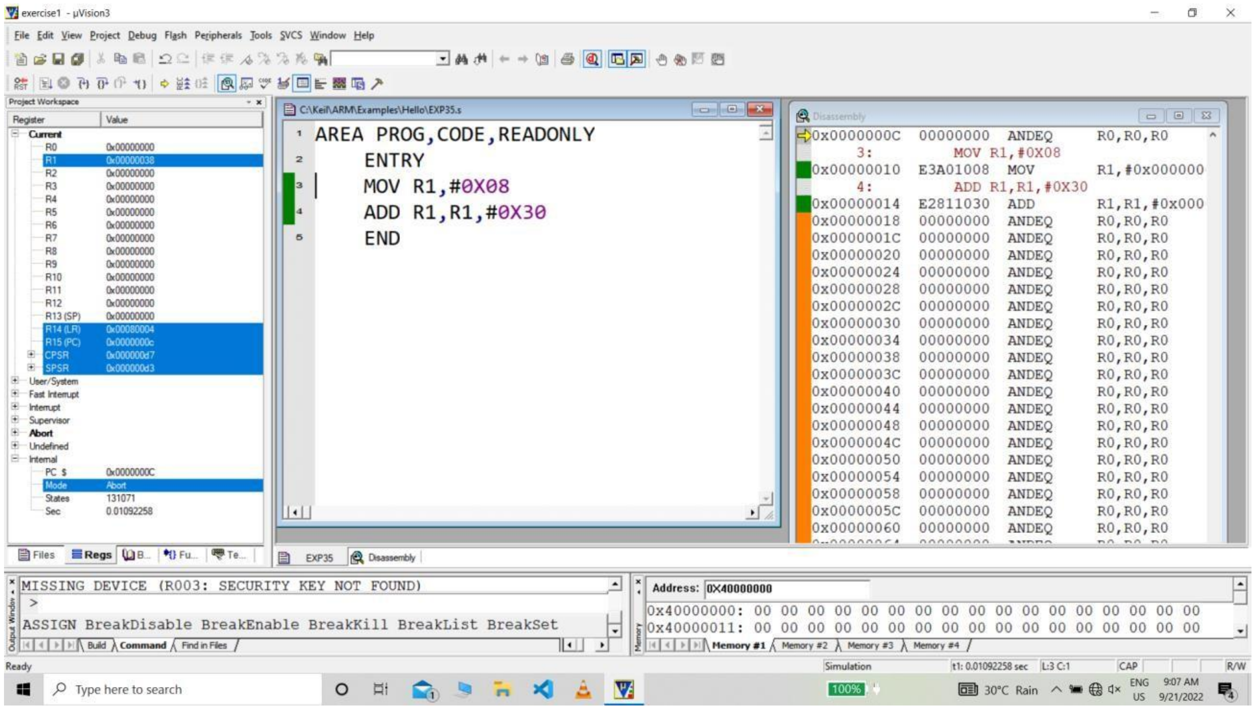
QUESTION 5

Write a program to convert unpacked BCD number into ASCII number.

CODE:

```
AREA PROG,CODE,READONLY
        ENTRY
        MOV R1,#0X08
        ADD R1,R1,#0X30
        END
```

OUTPUT:



```
Register        Value
Current
  R0            0x00000000
  R1            0x00000038
  R2            0x00000000
  R3            0x00000000
  R4            0x00000000
  R5            0x00000000
  R6            0x00000000
  R7            0x00000000
  R8            0x00000000
  R9            0x00000000
  R10           0x00000000
  R11           0x00000000
  R12           0x00000000
  R13 (SP)      0x00000000
  R14 (LR)      0x00080004
  R15 (PC)      0x0000000c
  CPSR          0x000000d7
  SPSR          0x000000d3
User/System
Fast Interrupt
Interrupt
Supervisor
Abort
Undefined
Internal
  PC $          0x0000000C
  Mode          Abort
  States        131071
  Sec           0.01092258
```

```
AREA PROG,CODE,READONLY
    ENTRY
    MOV R1,#0X08
    ADD R1,R1,#0X30
    END
```

```
0x0000000C  00000000  ANDEQ     R0,R0,R0
     3:          MOV R1,#0X08
0x00000010  E3A01008  MOV       R1,#0x000000
     4:          ADD R1,R1,#0X30
0x00000014  E2811030  ADD       R1,R1,#0x000
0x00000018  00000000  ANDEQ     R0,R0,R0
0x0000001C  00000000  ANDEQ     R0,R0,R0
0x00000020  00000000  ANDEQ     R0,R0,R0
0x00000024  00000000  ANDEQ     R0,R0,R0
0x00000028  00000000  ANDEQ     R0,R0,R0
0x0000002C  00000000  ANDEQ     R0,R0,R0
0x00000030  00000000  ANDEQ     R0,R0,R0
0x00000034  00000000  ANDEQ     R0,R0,R0
0x00000038  00000000  ANDEQ     R0,R0,R0
0x0000003C  00000000  ANDEQ     R0,R0,R0
0x00000040  00000000  ANDEQ     R0,R0,R0
0x00000044  00000000  ANDEQ     R0,R0,R0
0x00000048  00000000  ANDEQ     R0,R0,R0
0x0000004C  00000000  ANDEQ     R0,R0,R0
0x00000050  00000000  ANDEQ     R0,R0,R0
0x00000054  00000000  ANDEQ     R0,R0,R0
0x00000058  00000000  ANDEQ     R0,R0,R0
0x0000005C  00000000  ANDEQ     R0,R0,R0
0x00000060  00000000  ANDEQ     R0,R0,R0
```

```
MISSING DEVICE (R003: SECURITY KEY NOT FOUND)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet
```

```
Address: 0X40000000
0x40000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x40000011: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

exercise1 - µVision3
File Edit View Project Debug Flash Peripherals Tools SVCS Window Help
Project Workspace
C:\Keil\ARM\Examples\Hello\EXP35.s
Disassembly
Files Regs B... Fu... Te...
EXP35 Disassembly
Build Command Find in Files
Memory #1 Memory #2 Memory #3 Memory #4
Ready
Simulation
t1: 0.01092258 sec
L:3 C:1
CAP
R/W
Type here to search
100%
30°C Rain
ENG US
9:07 AM 9/21/2022

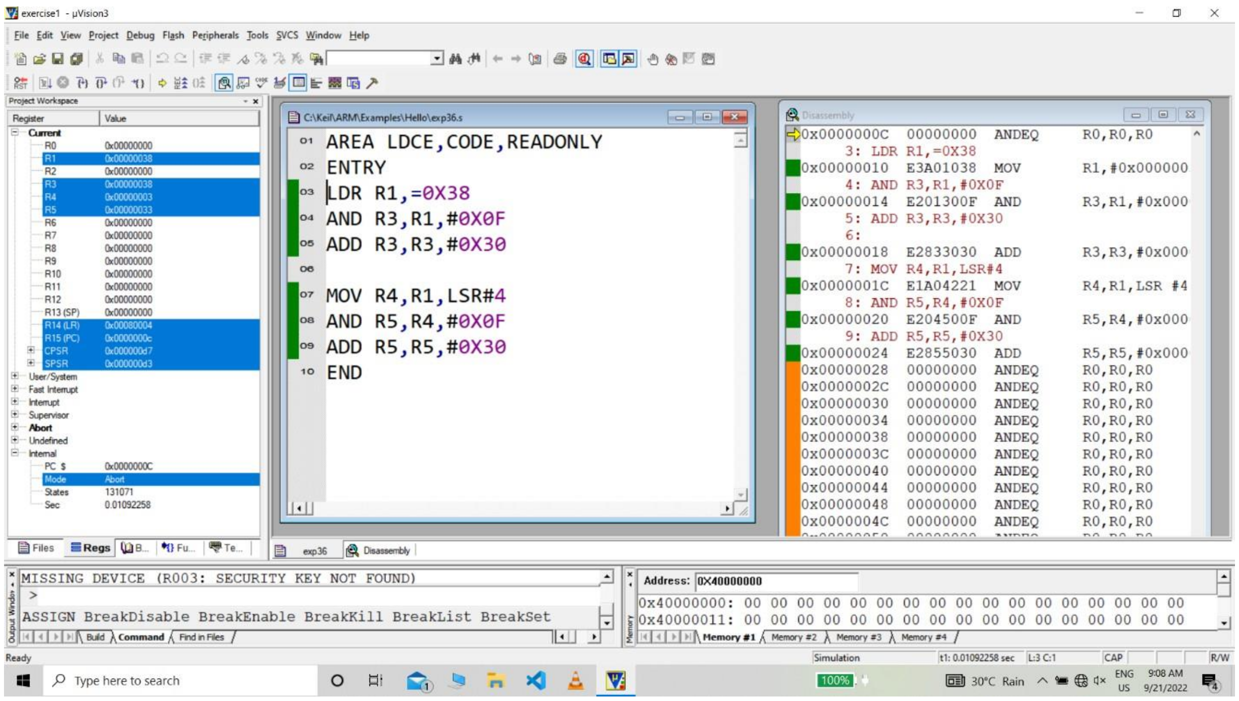
QUESTION 6

Write a program to convert packed BCD number into ASCII number.

CODE:

```
AREA LDCE,CODE,READONLY
ENTRY
LDR R1,=0X38
AND R3,R1,#0X0F
ADD R3,R3,#0X30
MOV R4,R1,LSR#4
AND R5,R4,#0X0F
ADD R5,R5,#0X30
END
```

OUTPUT:



exercise1 - µVision3

C:\Keil\ARM\Examples\Hello\exp36.s

```
AREA LDCE,CODE,READONLY
ENTRY
LDR R1,=0X38
AND R3,R1,#0X0F
ADD R3,R3,#0X30

MOV R4,R1,LSR#4
AND R5,R4,#0X0F
ADD R5,R5,#0X30
END
```

Register	Value
Current	
R0	0x00000000
R1	0x00000038
R2	0x00000000
R3	0x00000038
R4	0x00000003
R5	0x00000033
R6	0x00000000
R7	0x00000000
R8	0x00000000
R9	0x00000000
R10	0x00000000
R11	0x00000000
R12	0x00000000
R13 (SP)	0x00000000
R14 (LR)	0x00080004
R15 (PC)	0x0000000c
CPSR	0x000000d7
SPSR	0x000000d3
User/System	
Fast Interrupt	
Interrupt	
Supervisor	
Abort	
Undefined	
Internal	
PC $	0x0000000C
Mode	Abort
States	131071
Sec	0.01092258

Disassembly

```
0x0000000C  00000000  ANDEQ     R0,R0,R0
     3: LDR R1,=0X38
0x00000010  E3A01038  MOV       R1,#0x000000
     4: AND R3,R1,#0X0F
0x00000014  E201300F  AND       R3,R1,#0x000
     5: ADD R3,R3,#0X30
     6:
0x00000018  E2833030  ADD       R3,R3,#0x000
     7: MOV R4,R1,LSR#4
0x0000001C  E1A04221  MOV       R4,R1,LSR #4
     8: AND R5,R4,#0X0F
0x00000020  E204500F  AND       R5,R4,#0x000
     9: ADD R5,R5,#0X30
0x00000024  E2855030  ADD       R5,R5,#0x000
0x00000028  00000000  ANDEQ     R0,R0,R0
0x0000002C  00000000  ANDEQ     R0,R0,R0
0x00000030  00000000  ANDEQ     R0,R0,R0
0x00000034  00000000  ANDEQ     R0,R0,R0
0x00000038  00000000  ANDEQ     R0,R0,R0
0x0000003C  00000000  ANDEQ     R0,R0,R0
0x00000040  00000000  ANDEQ     R0,R0,R0
0x00000044  00000000  ANDEQ     R0,R0,R0
0x00000048  00000000  ANDEQ     R0,R0,R0
0x0000004C  00000000  ANDEQ     R0,R0,R0
```

```
MISSING DEVICE (R003: SECURITY KEY NOT FOUND)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet
```

```
Address: 0X40000000
0x40000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x40000011: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

Ready | Simulation | t1: 0.01092258 sec | L:3 C:1 | CAP | R/W

File Edit View Project Debug Flash Peripherals Tools SVCS Window Help
Project Workspace
Files Regs B... Fu... Te...
exp36 Disassembly
Build Command Find in Files
Memory #1 Memory #2 Memory #3 Memory #4
Type here to search
100%
30°C Rain
ENG US
9:08 AM 9/21/2022

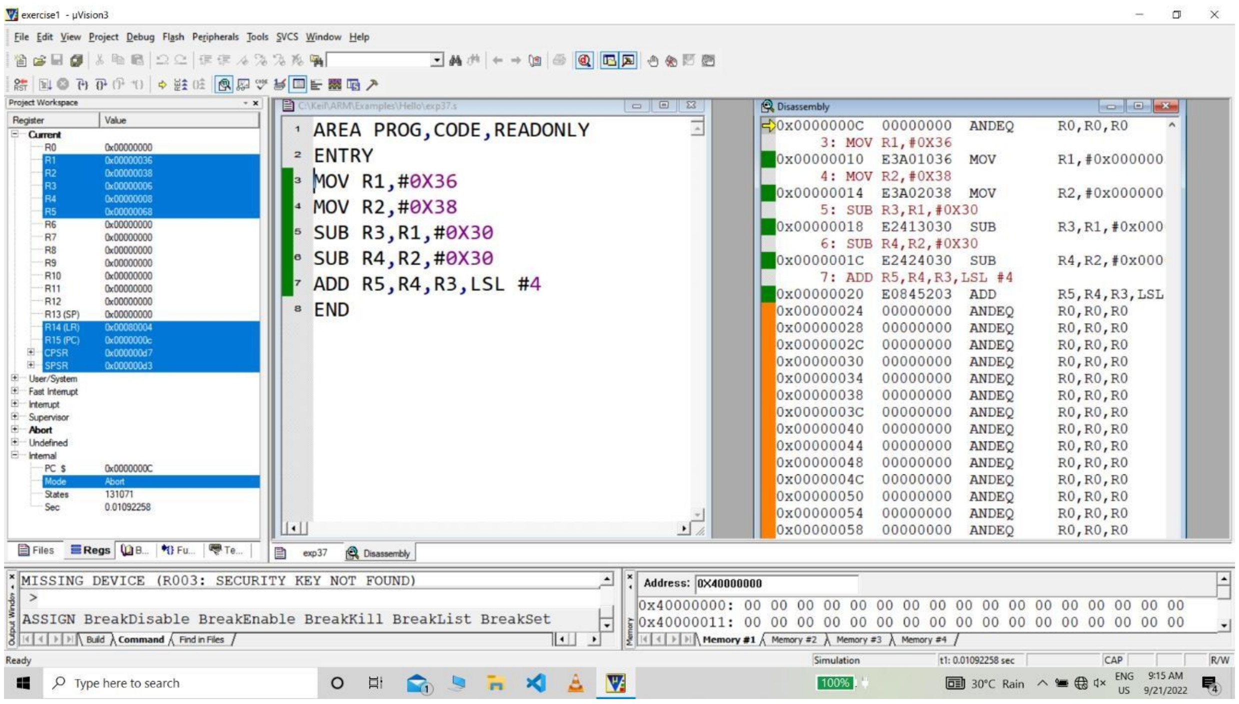
QUESTION 7

Write a program to convert ASCII number into packed BCD number.

CODE:

```
AREA PROG,CODE,READONLY
ENTRY
MOV R1,#0X36
MOV R2,#0X38
SUB R3,R1,#0X30
SUB R4,R2,#0X30
ADD R5,R4,R3,LSL #4
END
```

OUTPUT:



```
Register        Value
Current
  R0            0x00000000
  R1            0x00000036
  R2            0x00000038
  R3            0x00000006
  R4            0x00000008
  R5            0x00000068
  R6            0x00000000
  R7            0x00000000
  R8            0x00000000
  R9            0x00000000
  R10           0x00000000
  R11           0x00000000
  R12           0x00000000
  R13 (SP)      0x00000000
  R14 (LR)      0x00080004
  R15 (PC)      0x0000000c
  CPSR          0x000000d7
  SPSR          0x000000d3
User/System
Fast Interrupt
Interrupt
Supervisor
Abort
Undefined
Internal
  PC $          0x0000000C
  Mode          Abort
  States        131071
  Sec           0.01092258
```

```
AREA PROG,CODE,READONLY
ENTRY
MOV R1,#0X36
MOV R2,#0X38
SUB R3,R1,#0X30
SUB R4,R2,#0X30
ADD R5,R4,R3,LSL #4
END
```

```
0x0000000C  00000000  ANDEQ   R0,R0,R0
     3: MOV R1,#0X36
0x00000010  E3A01036  MOV     R1,#0x000000
     4: MOV R2,#0X38
0x00000014  E3A02038  MOV     R2,#0x000000
     5: SUB R3,R1,#0X30
0x00000018  E2413030  SUB     R3,R1,#0x000
     6: SUB R4,R2,#0X30
0x0000001C  E2424030  SUB     R4,R2,#0x000
     7: ADD R5,R4,R3,LSL #4
0x00000020  E0845203  ADD     R5,R4,R3,LSL
0x00000024  00000000  ANDEQ   R0,R0,R0
0x00000028  00000000  ANDEQ   R0,R0,R0
0x0000002C  00000000  ANDEQ   R0,R0,R0
0x00000030  00000000  ANDEQ   R0,R0,R0
0x00000034  00000000  ANDEQ   R0,R0,R0
0x00000038  00000000  ANDEQ   R0,R0,R0
0x0000003C  00000000  ANDEQ   R0,R0,R0
0x00000040  00000000  ANDEQ   R0,R0,R0
0x00000044  00000000  ANDEQ   R0,R0,R0
0x00000048  00000000  ANDEQ   R0,R0,R0
0x0000004C  00000000  ANDEQ   R0,R0,R0
0x00000050  00000000  ANDEQ   R0,R0,R0
0x00000054  00000000  ANDEQ   R0,R0,R0
0x00000058  00000000  ANDEQ   R0,R0,R0
```

```
MISSING DEVICE (R003: SECURITY KEY NOT FOUND)
>
ASSIGN BreakDisable BreakEnable BreakKill BreakList BreakSet
```

```
Address: 0X40000000
0x40000000: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0x40000011: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```

exercise1 - µVision3
File Edit View Project Debug Flash Peripherals Tools SVCS Window Help
Project Workspace
C:\Keil\ARM\Examples\Hello\exp37.s
Disassembly
Files Regs B... Fu... Te...
exp37 Disassembly
Build Command Find in Files
Memory #1 Memory #2 Memory #3 Memory #4
Ready Simulation t1: 0.01092258 sec CAP R/W
Type here to search
100%
30°C Rain
ENG US 9:15 AM 9/21/2022