



دانشگاه صنعتی اصفهان
دانشکده مهندسی برق و کامپیوتر

عنوان: تکلیف چهارم درس ریزپردازنده

نام و نام خانوادگی: علیرضا ابره فروش

شماره دانشجویی: ۹۸۱۶۶۰۳

نیم سال تحصیلی: پاییز ۱۴۰۰

مدرس: دکتر عارف کریمی افشار

فهرست مطالب

۱	سوال اول	۲
۲	سوال دوم	۳
۳	سوال سوم	۵
۴	سوال چهارم	۶

۱ سوال اول

```
.ORG 100

LDI R16, 0b00010011

LDI R17, 0b11101110

ADD R16, R17

NOP
```

The screenshot shows the 'Output' window of AVR Studio. The 'Show output from:' dropdown is set to 'Build'. The output text is as follows:

```
----- Build started: Project: 1, Configuration: Debug AVR -----
Build started.
Project "1.asmproj" (default targets):
Target "PreBuildEvent" skipped, due to false condition; ('$(PreBuildEvent)'!='') was evaluated as (''!='').
Target "CoreBuild" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Assembler.targets" from project "C:\Users\Alireza\Desktop\HW\Homework\Microprocessor\2\1\1.asmproj" (target "Build" depends on it):
Task "RunAssemblerTask"
C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr\avrassembler\avras2.exe -fI -o "1.hex" -m "1.map" -l "1.lss" -S "1.tmp" -W -I "C:\Program Files (x86)\Atmel\Studio\7.0\Packs\atmel\Atmega_DFP\1.2.209\avras\inc"
AVRASM: AVR macro assembler 2.2.7 (build 69 Jul 26 2017 16:25:06)
Copyright (C) 1995-2017 ATMEL CORPORATION
[builtin](2): Including file 'C:\Program Files (x86)\Atmel\Studio\7.0\Packs\atmel\Atmega_DFP\1.2.209\avras\inc\m32def.inc'
"ATmega32" memory use summary [bytes]:
-----
Segment  Begin    End      Code  Data  Used  Size  Use%
-----
[.cseg] 0x0000c8 0x0000ce      6    0    6   32768  0.0%
[.dseg] 0x000060 0x000060      0    0    0    2048  0.0%
[.eseg] 0x000000 0x000000      0    0    0    1024  0.0%
-----
Assembly complete, 0 errors, 0 warnings
Done executing task "RunAssemblerTask".
Done building target "CoreBuild" in project "1.asmproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(PostBuildEvent)'!='') was evaluated as (''!='').
Target "Build" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Avr.common.targets" from project "C:\Users\Alireza\Desktop\HW\Homework\Microprocessor\2\1\1.asmproj" (entry point):
Done building target "Build" in project "1.asmproj".
Done building project "1.asmproj".

Build succeeded.
----- Build: 1 succeeded or up-to-date, 0 failed, 0 skipped -----
|
```

شکل ۱: خروجی

Processor Status	
Name	Value
Program Counter	0x00000000
Stack Pointer	0x0000
X Register	0x0000
Y Register	0x0000
Z Register	0x0000
Status Register	ITHSVNZC
Cycle Counter	16384
Frequency	1.000 MHz
Stop Watch	16,384.00 μ s
Registers	
R00	0x00
R01	0x00
R02	0x00
R03	0x00
R04	0x00
R05	0x00
R06	0x00
R07	0x00
R08	0x00
R09	0x00
R10	0x00
R11	0x00
R12	0x00
R13	0x00
R14	0x00
R15	0x00
R16	0x01
R17	0xEE

شکل ۲: وضعیت پردازنده

در این جمع Carry (مجموع دو عدد بدون در نظر گرفتن علامت در مبنای ۲ برابر ۱۰۰۰۰۰۰۰۱ است) و Half Carry به نیمه دوم منتقل می‌کند) وجود دارد. در نتیجه رجیسترهای وضعیت H و C، ۱ هستند.

۲ سوال دوم

```
.ORG 100
LDI R16, 0b11111111
LDI R17, 0b11001010
MULS R16, R17
NOP
```

```

Output
Show output from: Build
----- Build started: Project: 2, Configuration: Debug AVR -----
Build started.
Project "2.asmproj" (default targets):
Target "PreBuildEvent" skipped, due to false condition; ('$(PreBuildEvent)'!='') was evaluated as (''!='').
Target "CoreBuild" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Assembler.targets" from project "C:\Users\Alireza\Desktop\HW\Homework\Microprocessor\2\2.2.asmproj" (target "Build" depends on it):
Task "RunAssemblerTask"
C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr8\avrasm\avrasm2.exe -fI -o "2.hex" -m "2.map" -l "2.lss" -S "2.tmp" -Wio -l "C:\Program Files (x86)\Atmel\Studio\7.0\Packs\atmel\Atmega_DFP\1.2.209\avrasm\inc"
AVRASM: AVR macro assembler 2.2.7 (build 69 Jul 26 2017 16:25:06)
Copyright (C) 1995-2017 ATMEL CORPORATION
[builtin](2): Including file 'C:\Program Files (x86)\Atmel\Studio\7.0\Packs\atmel\Atmega_DFP\1.2.209\avrasm\inc\m32def.inc'
"ATmega32" memory use summary [bytes]:
Segment  Begin  End  Code  Data  Used  Size  Use%
-----
[.cseg] 0x0000c8 0x0000ce    6    0    6 32768  0.0%
[.dseg] 0x000060 0x000060    0    0    0 2048  0.0%
[.eseg] 0x000000 0x000000    0    0    0 1024  0.0%
Assembly complete, 0 errors, 0 warnings
Done executing task "RunAssemblerTask".
Done building target "CoreBuild" in project "2.asmproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(PostBuildEvent)'!='') was evaluated as (''!='').
Target "Build" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Avr.common.targets" from project "C:\Users\Alireza\Desktop\HW\Homework\Microprocessor\2\2.2.asmproj" (entry point):
Done building target "Build" in project "2.asmproj".
Done building project "2.asmproj".

Build succeeded.
----- Build: 1 succeeded on up-to-date, 0 failed, 0 skipped -----

```

شکل ۳: خروجی

Processor Status	
Name	Value
Program Counter	0x00000000
Stack Pointer	0x0000
X Register	0x0000
Y Register	0x0000
Z Register	0x0000
Status Register	01101101
Cycle Counter	1245260
Frequency	1.000 MHz
Stop Watch	1,245,260.00 µs
Registers	
R00	0x36
R01	0x00
R02	0x00
R03	0x00
R04	0x00
R05	0x00
R06	0x00
R07	0x00
R08	0x00
R09	0x00
R10	0x00
R11	0x00
R12	0x00
R13	0x00
R14	0x00
R15	0x00
R16	0xFF
R17	0xCA
R18	0x00
R19	0x00
R20	0x00
R21	0x00
R22	0x00
R23	0x00
R24	0x00

شکل ۴: وضعیت پردازنده

ضرب علامتدار انجام گرفته است و نتیجه به درستی در R0 ریخته شده است.

۳ سوال سوم

```
LDI R16, 0b01111111
```

```
LDI R17, 0b01111111
```

```
ADD R16, R17
```

```
NOP
```

```

Output
Show output from: Build
----- Build started: Project: 3, Configuration: Debug AVR -----
Build started.
Project "3.asmproj" (default targets):
Target "PreBuildEvent" skipped, due to false condition; ('$(PreBuildEvent)'!='') was evaluated as (''!='').
Target "CoreBuild" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Assembler.targets" from project "C:\Users\Alireza\Desktop\HW\Homework\Microprocessor\2\3\3.asmproj" (target "Build" depends on it):
Task "RunAssemblerTask"
C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr\avrasm\avrasm2.exe -fi -o "3.hex" -m "3.map" -l "3.lss" -S "3.tmp" -M -I "C:\Program Files (x86)\Atmel\Studio\7.0\Packs\atmel\Atmega_DFP\1.2.209\avrasm\inc"
AVRASM: AVR macro assembler 2.2.7 (build 69 Jul 26 2017 16:25:06)
Copyright (C) 1995-2017 ATMEL CORPORATION
[builtin](2): Including file 'C:\Program Files (x86)\Atmel\Studio\7.0\Packs\atmel\Atmega_DFP\1.2.209\avrasm\inc\m32def.inc'
"ATmega32" memory use summary [bytes]:
Segment  Begin  End    Code  Data  Used  Size  Use%
-----
[.cseg] 0x000000 0x000008    8    0    8   32768  0.0%
[.dseg] 0x000060 0x000060    0    0    0    2048  0.0%
[.eseg] 0x000000 0x000000    0    0    0    1024  0.0%
Assembly complete, 0 errors, 0 warnings
Done executing task "RunAssemblerTask".
Done building target "CoreBuild" in project "3.asmproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(PostBuildEvent)'!='') was evaluated as (''!='').
Target "Build" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Avr.common.targets" from project "C:\Users\Alireza\Desktop\HW\Homework\Microprocessor\2\3\3.asmproj" (entry point):
Done building target "Build" in project "3.asmproj".
Done building project "3.asmproj".

Build succeeded.
----- Build: 1 succeeded on up-to-date, 0 failed, 0 skipped -----

```

شکل ۵: خروجی

Processor Status	
Name	Value
Program Counter	0x00000003
Stack Pointer	0x0000
X Register	0x0000
Y Register	0x0000
Z Register	0x0000
Status Register	
Cycle Counter	3
Frequency	1.000 MHz
Stop Watch	3.00 μ s
Registers	
R00	0x00
R01	0x00
R02	0x00
R03	0x00
R04	0x00
R05	0x00
R06	0x00
R07	0x00
R08	0x00
R09	0x00
R10	0x00
R11	0x00
R12	0x00
R13	0x00
R14	0x00
R15	0x00
R16	0xFE
R17	0x7F
R18	0x00
R19	0x00
R20	0x00
R21	0x00
R22	0x00
R23	0x00
R24	0x00

شکل ۶: وضعیت پردازنده

هنگامی که ۱۲۷ و ۱۲۷ را در مبنای ۲ با استفاده از رجیسترهای ۸ بیتی جمع می‌کنیم نتیجه ۱۱۱۱۱۱۱۰ در مبنای ۲ می‌شود که مکمل-۲ عدد ۲- است. حاصل جمع منفی دو عملوند مثبت (یا بالعکس) نشان‌دهنده‌ی سرریز (overflow) است و رجیستر V را ۱ می‌کند.

۴ سوال چهارم

```
LDI R20, $67
LDI R21, $99
ADD R20, R21
NOP
```

Name	Value
Program Counter	0x00000003
Stack Pointer	0x0000
X Register	0x0000
Y Register	0x0000
Z Register	0x0000
Status Register	I T H S V N Z C
Cycle Counter	3
Frequency	1.000 MHz
Stop Watch	3.00 μ s

شکل ۷: رجیسترهای وضعیت

جمع اعداد در مبنای ۱۶ برابر ۱۰۰ است. در نتیجه Carry داریم. همچنین چون Carry به نیمه دوم منتقل می‌شود Half Carry داریم. در آخر رجیستر Z نشان‌دهنده‌ی این مسئله است که جمع به ۰۰ منتهی شده است.

منابع