



دانشگاه صنعتی اصفهان
دانشکده مهندسی برق و کامپیوتر

عنوان: تکلیف دوم درس ریزپردازنده

نام و نام خانوادگی: علیرضا ابره فروش

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مدرس: دکتر عارف کریمی افشار

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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; ('$(PreBuildEvent)' != '') was evaluated as ('' != '').
Target "CoreBuild" in file "C:\Program Files (x86)\Atmel\Studio\7.0\Vs\Assembler.targets" from project "C:\Users\Alireza\Desktop\HW\Homework\Microprocessor\2\1\1.asmproj" (target "Build" depends on it):
Task "RunAssemblerTask"
C:\Program Files (x86)\Atmel\Studio\7.0\toolchain\avr8\avrassembler\avras2.exe -fI -o "1.hex" -m "1.map" -l "1.lss" -S "1.tmp" -W -I "C:\Program Files (x86)\Atmel\Studio\7.0\Packs\atmel\Atmega_DFP\1.2.209\avras\inc"
AVRASM: AVR macro assembler 2.2.7 (build 69 Jul 26 2017 16:25:06)
Copyright (C) 1995-2017 ATMEL CORPORATION
[builtin](2): Including file 'C:\Program Files (x86)\Atmel\Studio\7.0\Packs\atmel\Atmega_DFP\1.2.209\avras\inc\m32def.inc'
"ATmega32" memory use summary [bytes]:
-----
Segment  Begin    End      Code  Data  Used  Size  Use%
-----
[.cseg] 0x0000c8 0x0000ce      6    0    6   32768  0.0%
[.dseg] 0x000060 0x000060      0    0    0    2048  0.0%
[.eseg] 0x000000 0x000000      0    0    0    1024  0.0%
-----
Assembly complete, 0 errors, 0 warnings
Done executing task "RunAssemblerTask".
Done building target "CoreBuild" in project "1.asmproj".
Target "PostBuildEvent" skipped, due to false condition; ('$(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 on up-to-date, 0 failed, 0 skipped -----
|
```

شکل ۱: خروجی

شکل ۲: وضعیت پردازنده

۲ سوال دوم

علیرضا ابره فروش

```

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