

# Lab Report

**ECPE 170 – Computer Systems and Networks – Spring 2016**

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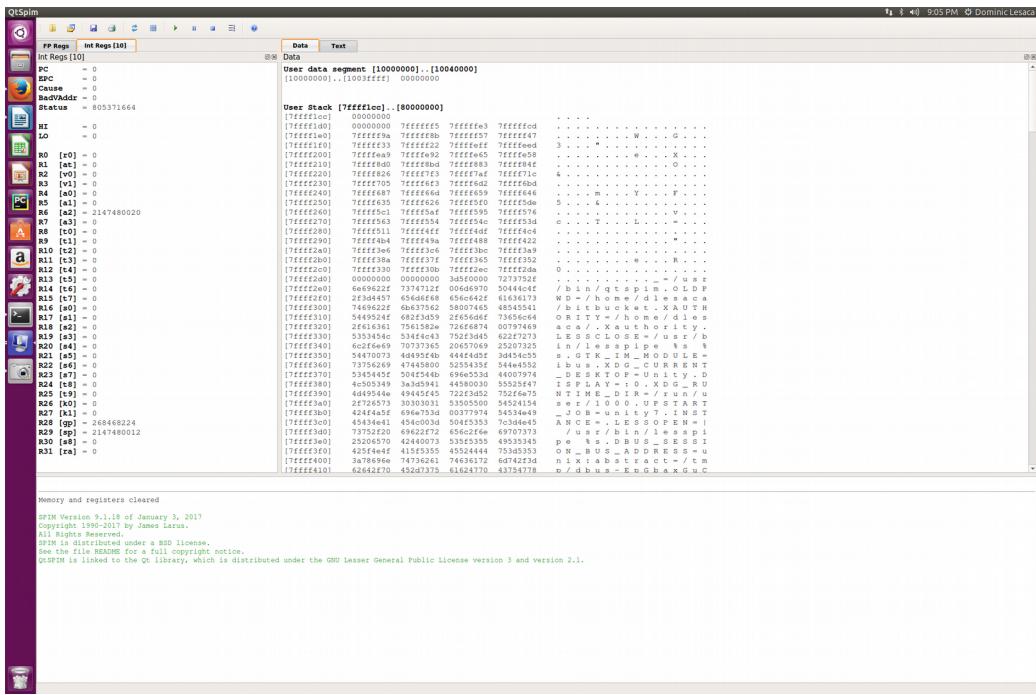
**Lab Topic:** MIPS Assembly Programming (Lab #: 10)

## Question #1:

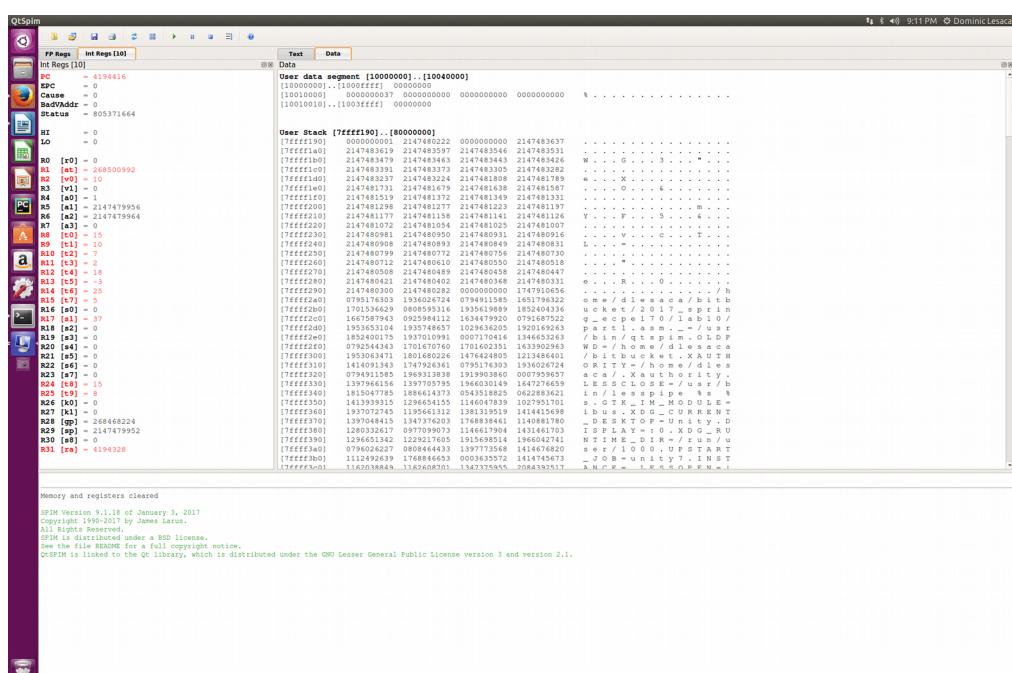
Take two screenshots of the MIPS register panel: one before your program runs, and one after your program finishes. Put the register panel in Decimal mode (right-click) so it is easy to see register values.

## Answer:

Before:



After:



## Question #2:

Take two screenshots of the MIPS memory panel (data tab): one before your program runs, and one after your program finishes. Put the memory panel in Decimal mode (right-click), so it is easy to see memory values. In the after-execution capture, **circle the memory location (not register) that contains the final calculated value of Z.**

**Answer:**

Before:

After:

The screenshot shows the QSpim debugger interface with the following details:

- Registers:** FP Regs, Int Regs [10], Registers [10].
- Text / Data:** Text tab is selected.
- Memory and registers cleared:** Status message at the bottom left.
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- QSpim License:** QSpim is linked to the Qt library, which is distributed under the GNU Lesser General Public License version 3 and version 2.1.
- User data segment:** Address range [10000000]..[10040000].
- Registers:** PC = 4394416, EPC = 0, Cause = 0, BadVaddr = 0, Status = 805371664, RE = 0, LO = 0, R0 = 0, RA = 48500992, R1 = 0, R2 = v01, R3 = v1, R4 = 10, R5 = 0, R6 = 1, R7 = 439477956, R8 = a01, R9 = 1, R10 = 15, R11 = 10, R12 = 1, R13 = 2, R14 = 18, R15 = 5, R16 = 7, R17 = 5, R18 = 37, R19 = 0, R20 = 0, R21 = 0, R22 = 0, R23 = 0, R24 = 0, R25 = 0, R26 = 0, R27 = 0, R28 = gp, R29 = 234747952, R30 = 0, R31 = ra = 194328.
- Stack:** User Stack [7FFF1F00]..[80000000].
- Code View:** Shows assembly instructions from 7FFF1F00 to 7FFF3F00, including calls to \_start, main, and various function bodies like print\_s, print\_i, and print\_f.

### **Question #3-4:**

(3) Take two screenshots of the MIPS register panel: one before your program runs, and one after your program finishes. Put the register panel in Decimal mode (right-click) so it is easy to see register values.

(4) Take two screenshots of the MIPS memory panel (data tab): one before your program runs, and one after your program finishes. Put the memory panel in Decimal mode (right-click), so it is easy to see memory values. In the after-execution capture, **circle the memory location (not register) that contains the final calculated value of Z.**

**Answer:**

## Before:

```
FP Regs Int Regs [10] Text Data
Int Regs [10]
PC = 0
EPC = 0
Cause = 0
BadVaddr = 0
Status = 805371664

HI = 0
LO = 0

User Stack [7fffffb0]..[80000000]
[7fffffb0] 000000001 2147480260 000000000 2147483637 . . . . .
[7fffffc0] 2147483619 2147483597 2147483546 2147483531 . . . . .
[7fffffd0] 2147483479 2147483463 2147483443 2147483420 W . . G . . 3 . .
[7fffffe0] 2147483403 2147483368 2147483350 2147483282 . . . . .
[7fffff00] 2147483269 2147483234 2147483201 2147481785 { . . . N . . A . .
[7fffff10] 2147481765 2147481708 2147481703 2147481703 . . . . .
[7fffff20] 2147481564 2147481496 2147481349 2147481326 . . . . .
[7fffff30] 2147481308 2147481275 2147481254 2147481228 . . . . .
[7fffff40] 2147481210 2147481190 2147481171 2147481154 z . . f . . s . . B .
[7fffff50] 2147481139 2147481085 2147481067 2147481038 3 . . . . .
[7fffff60] 2147481020 2147480994 2147480963 2147480944 . . . . .
[7fffff70] 2147480929 2147480921 2147480906 2147480862 a . . Y . . J . .
[7fffff80] 2147480871 2147480844 2147480812 2147480785 . . . . .
[7fffff90] 2147480844 2147480812 2147480785 2147480769 . . . . .
[7fffffa0] 2147480743 2147480725 2147480623 2147480563 . . . . .
[7fffffb0] 2147480553 2147480521 2147480502 2147480473 . . . . .
[7fffffc0] 2147480502 2147480484 2147480465 2147480381 . . . . .
[7fffffd0] 2147480434 2147480326 000000000 000000000 . . . . .
[7fffffe0] 000000000 000000000 000000000 000000000 . . . . .
[7fffff00] 1836071771 1818505061 1667330917 . . . . .
[7fffff10] 1668637300 0796157291 0925970482 a / b i t b u c k e t / 2 0 1 7
[7fffff20] 1919972191 160613993 0701864293 0791689009 - s p r i n g _ e c p e / 1 7 0
[7fffff30] 0828531052 1634742064 0791835762 1953635104 l a b l o / p a r t 2 / p a r t
[7fffff40] 1935748658 029636205 1920169263 1852400175 2 _ a s m _ = / u s r / b i n
[7fffff50] 1397010991 0007170416 1418473423 1230131016 / q t s p i m _ X A U T H O R I
[7fffff60] 0792549711 1701670760 1701602351 1633902963 T Y = / h o m e / d l s a c a
[7fffff70] 1633168943 1869116533 2037673206 1397050368 / X a u t h o r i t y _ L E S
[7fffff80] 1330398035 0792544595 0796029813 0795765090 S C L O S E = / u s r / b i n /
[7fffff90] 1935748658 029636205 1634742064 0791835762 1 e s s p i p e _ = / s . g
[7fffffa0] 122098914 1330479043 1162539406 1159158131 1 9 9 9 _ M A P _ D E F E A T H
[7fffffb0] 1146617971 1340478663 1313163906 11621087574 s . X D G _ C U R R E N T _ D E
[7fffffc0] 1330923801 1851080041 007959565 1347635524 S K T O P _ U n x _ D I S P
[7fffffd0] 1029259596 1476407354 1381975876 1230261845 L A Y _ : 0 X D G _ R U N T I
[7fffffe0] 0792549713 07975618178 19129251177 M E _ D I R _ = / r u n / u s e r
[7ffffff0] 1147094349 0792549713 1330274132 / 1 0 0 0 . U P S T A R T _ J O
[7fffff00] 0808464687 1347747888 1380013139 1330274132 / 1 0 0 0 . U P S T A R T _ J O
[7fffff10] 1853177154 0930706537 1397639424 1129202004 B = u n i t y _ 7 _ I N S T A N C
[7fffff20] 1275084101 1330860689 1028539728 1966022780 E = _ L E S S O P E N = | / u
[7fffff30] 1647276659 1815047785 188614373 0543518825 s r / b i n / l e s s p i p e
[7fffff40] 1599296834 1397961613 1598967625 % s . D B U S _ S E S S I O N _ 
[7fffff50] 1599296834 1397961613 104920981 2000754777 : U S _ A D D R E S S _ u n i x
[7fffff60] 1397050368 049253865 166089152 1474626344 : a b s t r a c t _ = / m p _ d
[7fffff70] 0762541410 1686950456 1968851621 1474626344 b u s _ g o o g e _ z u h _ x
[7fffff80] 1147094882 1598116929 1397901636 1937059645 O _ D A T A _ R I G H T S _ / :
[7fffff90] 1752379250 0795177569 1853186677 1937036038 r / s h a r e / u b u n t u : /
[7fffffa0] 0796209813 1918986355 1852526101 0973725679 u s r / s h a r e / g n o m e :
[7fffffb0] 1920169263 1668246575 1932487777 1701994856 / u s r / l o c a l / s h a r e
```

After:

FP Regs | Int Regs [10] | Text | Data

Int Regs [10]

**PC** = 4194512  
**EPC** = 0  
**Cause** = 0  
**BadVAddr** = 0  
**Status** = 805371664

**HI** = 0  
**LO** = 0

**R0** [**r0**] = 0  
**R1** [**at**] = 268500992  
**R2** [**v0**] = 10  
**R3** [**v1**] = 0  
**R4** [**a0**] = 1  
**R5** [**a1**] = 2147479988  
**R6** [**a2**] = 2147479996  
**R7** [**a3**] = 0  
**R8** [**t0**] = 10  
**R9** [**t1**] = 15  
**R10** [**t2**] = 6  
**R11** [**t3**] = 0  
**R12** [**t4**] = 0  
**R13** [**t5**] = 0  
**R14** [**t6**] = 0  
**R15** [**t7**] = 0  
**R16** [**t8**] = 0  
**R17** [**s1**] = 7  
**R18** [**a2**] = 0  
**R19** [**a3**] = 0  
**R20** [**s4**] = 0  
**R21** [**s5**] = 0  
**R22** [**s6**] = 0  
**R23** [**s7**] = 0  
**R24** [**t8**] = 0  
**R25** [**t9**] = 0  
**R26** [**t10**] = 0  
**R27** [**x1**] = 0  
**R28** [**gp**] = 268468224  
**R29** [**sp**] = 2147479984  
**R30** [**s8**] = 0  
**R31** [**ra**] = 4194328

User data segment [10000000]..[10040000]  
[10000000]..[1000ffff] 00000000  
[10010000] 0000000010 0000000015 0000000006 0000000007  
[10010010]..[1003ffff] 00000000

User Stack [7fffffb0]..[80000000]  
[7fffffb0] 0000000001 2147480260 0000000000 2147483637 . . . . .  
[7fffffc0] 2147483619 2147483597 2147483546 2147483531 . . . . .  
[7fffffd0] 2147483476 2147483463 2147483443 2147483420 W . . . G . . . 3 . . . . .  
[7fffffe0] 2147483403 2147483368 2147483350 2147483282 . . . . .  
[7fffff00] 2147483259 2147483214 2147483201 2147481785 ( . . . N . . A . . . . .  
[7fffff10] 2147481766 2147481708 2147481656 2147481615 . . . . .  
[7fffff20] 2147481564 2147481498 2147481349 2147481326 . . . . .  
[7fffff30] 2147481275 2147481254 2147481234 2147481198 . . . . .  
[7fffff40] 2147481210 2147481190 2147481154 2147481154 z . . . f . . . S . . B . . .  
[7fffff50] 2147481139 2147481085 2147481067 2147481038 3 . . . . .  
[7fffff60] 2147481020 2147480994 2147480963 2147480944 . . . . .  
[7fffff70] 2147480929 2147480921 2147480906 2147480962 a . . . Y . . J . . .  
[7fffff80] 2147480844 2147480812 2147480785 2147480769 . . . . .  
[7fffff90] 2147480743 2147480725 2147480623 2147480563 . . . . .  
[7fffffa0] 2147480531 2147480521 2147480502 2147480471 . . . . .  
[7fffffb0] 2147480460 2147480434 2147480415 2147480381 . . . . .  
[7fffffc0] 2147480344 2147480324 0000000000 0000000000 . . . . .  
[7fffffd0] 0000000000 183601711 818505084 146733817 . . . . .  
[7fffffe0] 1768042337 1668637300 0796157291 09250790482 a / b i t b u c k e t / 2 0 7 /  
[7ffffff0] 1919972327 1600613993 1701864293 0791689009 s p r i n g \_ e c p e l 7 0 /  
[7fffff00] 0828531052 1634742064 0791835762 1953653104 l a b l 0 / p a r t 2 / p a r t  
[7fffff10] 1935748658 1029636205 1920169263 1852400175 2 . a s m . = / u s r / b i n  
[7fffff20] 1937010991 0077107416 1414873432 1230131016 / q t s p i m . R A U T H O R I  
[7fffff30] 1701670760 1701602351 1633902963 T Y = / h o m e / d / l e s a c a  
[7fffff40] 1363168943 1869116533 2037672306 1397050368 / . X a u t h o r i t y . L E S  
[7fffff50] 1330398035 0792544595 0796029813 0975765090 S C L O S E / - / u s r / b i n /  
[7fffff60] 1347747888 1347747888 1380013139 130274132 T K R E D I T - / - / D U B E l i n u  
[7fffff70] 1230924271 1851080016 0007959657 1247625524 a X D G \_ S C U R E R Y \_ N T D E  
[7fffff80] 1029259596 1476407354 1381975876 1230261845 E = . L E S S O P E N = / u  
[7fffff90] 1140808165 1599296834 1397966163 1598967625 L A Y = : 0 . X D G \_ R U N T I  
[7fffffa0] 1380013139 130274132 119251317 M E \_ D I R = / r u n / u s e r  
[7fffffb0] 1347747888 1347747888 130274132 / 1 0 0 . U P P S T A R T \_ J O  
[7fffffc0] 0808464687 1347747888 1380013139 130274132 B = u n i t y 7 . I N S T A N C  
[7fffffd0] 1275084101 1330860869 1028539728 1966022780 E = . L E S S O P E N = / u  
[7fffffe0] 1647276659 1815047785 1886614373 0543518825 s r / b i n / l e s s s p i p e  
[7ffffff0] 1140808165 1599296834 1397966163 1598967625 % s . D B U S \_ S E S S I O N -  
[7fffff00] 1380013139 130274132 119251317 B U S \_ A P P \_ E S S = u n i x  
[7fffff10] 1393826333 1489326333 1489326333 1489326333 T B S = / b s / s a d  
[7fffff20] 0762541110 1866950456 1968800021 1476426344 b u s \_ 8 g G o o d Z u h z . X  
[7fffff30] 1147094820 1598116929 1397901636 1937059645 D G \_ D A T A \_ D I R S = / u  
[7fffff40] 1752379250 0795177569 1853186677 0792360308 r / s h a r e / u b u n t u : /  
[7fffff50] 0796029813 1918986355 1852256101 0979725679 u s r / s h a r e / g n o m e :  
[7fffff60] 1920169263 1668246575 1932487777 1701994856 / u s r / l o c a l / s h a r e

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Memory and registers cleared

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## Question 5-6:

(5) Take a screenshot of the MIPS register panel after your program finishes. Put the register panel in Decimal mode (right-click) so it is easy to see register values.

(6) Take a screenshot of the MIPS memory panel (data tab) after your program finishes. Put the memory panel in Decimal mode (right-click), so it is easy to see memory values. **Circle the memory location (not register) that contains the final calculated values of I and Z.**

**Answer:**

```

FP Regs Int Regs [10] Int Regs [10]
Text Data Data
User data segment [10000000]..[10040000]
[10000000]..[10010003] 00000000
[10010004] 0000000078 0000000000 0000000000
[10010010]..[1003ffff] 00000000

User Stack [7fffffb1b0]..[80000000]
[7fffffb1b0] 2147483139 21474831065 21474831067 21474831038
[7fffffb1d0] 2147483169 2147483250 2147483346 2147483531
[7fffffb1e0] 2147483403 2147483368 2147483350 2147483282
[7fffffb1f0] 2147483259 2147483214 2147483201 2147481785
[7fffffb200] 2147481766 2147481708 2147481656 2147481615
[7fffffb210] 2147481564 2147481496 2147481349 2147481326
[7fffffb220] 2147481308 2147481275 2147481254 2147481228
[7fffffb230] 2147481209 2147481190 2147481171 2147481154
[7fffffb240] 2147481139 2147481085 2147481067 2147481038
[7fffffb250] 2147481010 2147480956 2147480935 2147480914
[7fffffb260] 2147480929 2147480921 2147480906 2147480862
[7fffffb270] 2147480844 2147480812 2147480875 2147480769
[7fffffb280] 2147480743 2147480725 2147480623 2147480563
[7fffffb290] 2147480531 2147480521 2147480502 2147480471
[7fffffb2a0] 2147480460 2147480434 2147480415 2147480381
[7fffffb2b0] 2147480344 2147480326 0000000000 0000000000
[7fffffb2c0] 0000000000 183601771 1818505061 1667330917
[7fffffb2d0] 1768042337 166863730 0796157291 0925970482
[7fffffb2e0] 1912721291 1668613993 1701642493 0925970099
[7fffffb2f0] 0925970482 1623917256 0796157291 195365141
[7fffffb300] 1935748659 1029636205 1920169263 1852409175
[7fffffb310] 193701099 00071074016 14148773432 1230131016
[7fffffb320] 0792549716 1701670760 1701602351 1633902963
[7fffffb330] 1633168943 1869116533 2037672306 1397050368
[7fffffb340] 1330398035 0792544595 0796029813 0795765090
[7fffffb350] 1936942444 1701865840 0544417056 1191211813
[7fffffb360] 1230981972 1330470733 1162630468 1969383741
[7fffffb370] 1146617971 1430478663 1313165906 1162108756
[7fffffb380] 1330924371 1851080016 007959657 1347635524
[7fffffb390] 1330924396 1430477358 188175864 1347635524
[7fffffb3a0] 1147094513 0792547113 179576175 191952117
[7fffffb3b0] 0808464687 1347747888 1380013139 132074132
[7fffffb3c0] 1853177154 0930706537 1397639424 1129202004
[7fffffb3d0] 1275084103 1330860869 1028539728 1966022780
[7fffffb3e0] 1647276659 1815047785 1886614373 0543518825
[7fffffb3f0] 1140808165 1599296834 1397966163 1598967625
[7fffffb400] 1599296834 1380205633 1028870981 2020175477
[7fffffb410] 1935827258 1667330676 1949252980 1680830573
[7fffffb420] 0762541410 1866950458 1968850021 1476426344
[7fffffb430] 1147094852 1598116929 1397901636 1937059645
[7fffffb440] 1752379250 0795177569 1853186677 0792363038
[7fffffb450] 0796029813 1918986355 1852256101 0979725679
[7fffffb460] 1920169263 1668246575 1932487777 1701994956

```

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## Question 7-8:

(7) Take a screenshot of the MIPS register panel after your program finishes. Put the register panel in Decimal mode (right-click) so it is easy to see register values.

(8) Take a screenshot of the MIPS memory panel (data tab) after your program finishes. Put the memory panel in Decimal mode (right-click), so it is easy to see memory values. **Circle the final values of array A.**

**Answer:**

## Question 9:

(9) Take a screenshot of the MIPS memory panel (data tab) after your program finishes. Put the memory panel in Hex mode (right-click), since Decimal mode will not allow us to distinguish between bytes. **Circle two things: the final value of the pointer 'result' in memory, and the corresponding location that result points to.** Does that location in memory contain the ASCII code for the character 'e'? *(If not, you had better check your work!)*

**Answer:**

FP Regs Int Regs [10]

	Text	Data
Int Regs [10]		
PC	= 4194540	
EPC	= 0	
Cause	= 0	
BadVAddr	= 0	
Status	= 805371664	
HI	= 0	
LO	= 0	
R0 [r0]	= 0	
R1 [at]	= 268500992	
R2 [v0]	= 10	
R3 [v1]	= 0	
R4 [a0]	= 101	
R5 [a1]	= 105	
R6 [a2]	= 2147479996	
R7 [a3]	= 0	
R8 [t0]	= 268500992	
R9 [t1]	= 101	
R10 [t2]	= 0	
R11 [t3]	= 0	
R12 [t4]	= 0	
R13 [t5]	= 0	
R14 [t6]	= 0	
R15 [t7]	= 0	
R16 [t8]	= 268500992	
R17 [s1]	= 268500992	
R18 [s2]	= 0	
R19 [s3]	= 0	
R20 [s4]	= 0	

User data segment [10000000]..[10040000]

```
[10000000]..[1000ffff] 00000000 00000000 00000000 00000000 e b b . . . . . .
[10001000]..[1000ffff] 00000000 00000000 00000000 00000000 . . . F i r s t m a t c h
[10001000]..[10001000] 737269446 61e2d2074 20686374 . . . F i r s t m a t c h
[10001010]..[10001000] 61207462 65726464 00207373 20656854 a t a d d r e s s . T h e
[100010120]..[10001000] 6374616d 676e6968 61868320 74636172 m a t c h i n g c h a r a c t e r
[100010130]..[10001000] 69207265 0a002073 206f4e00 6374616d e r i s . . . N o m a t c
[100010140]..[10001000] 6f662068 0a646e75 00000000 00000000 h f o u n d . . . . .
[100010150]..[1003ffff] 00000000
```

User Stack [7ffff1b0]..[80000000]

```
[7ffff1b0]..[7ffff1b0] 00000000 7ffffee5 7ffffee5 . . . . . .
[7ffff1c0]..[7ffff1c0] 7ffffe83 7ffffedc 7ffffe9a 7ffffeb8 . . . . . .
[7ffff1d0]..[7ffff1d0] 7ffffe57 7fffff47 7fffff33 7fffff1c W . . . G . . . 3 . . . .
[7ffff1e0]..[7ffff1e0] 7fffffb0 7fffffe08 7fffffed6 7fffffe92 W . . . G . . . 3 . . . .
[7ffff1f0]..[7ffff1f0] 7ffffe7b 7fffffe4e 7fffffe01 7fffffb9 i . . . N . . . A . . . .
[7ffff200]..[7ffff200] 7ffffba6 7fffff86c 7fffff838 7fffffb0f i . . . N . . . A . . . .
[7ffff210]..[7ffff210] 7fffff7dc 7fffff798 7fffff705 7fffff6ee i . . . N . . . A . . . .
[7ffff220]..[7ffff220] 7fffff6d0 7fffff6bb 7fffff6a6 7fffff68c z . . . f . . . S . . . B . . .
[7ffff230]..[7ffff230] 7fffff676 7fffff666 7fffff653 7fffff642 z . . . f . . . S . . . B . . .
[7ffff240]..[7ffff240] 7fffff633 7fffff5fd 7fffff5e6 7fffff5ce 3 . . . . . .
[7ffff250]..[7ffff250] 7fffff5b0 7fffff5a2 7fffff5d0 7fffff570 3 . . . . . .
[7ffff260]..[7ffff260] 7fffff5c0 7fffff5a4 7fffff5d6 7fffff5f6 a . . . Y . . . J . . . P . . .
[7ffff270]..[7ffff270] 7fffff50c 7fffff4ec 7fffff4d1 7fffff4c1 a . . . Y . . . J . . . P . . .
[7ffff280]..[7ffff280] 7fffff4a7 7fffff495 7fffff42f 7fffff3f3 a . . . Y . . . J . . . P . . .
[7ffff290]..[7ffff290] 7fffff3d3 7fffff3c9 7fffff3b6 7fffff397 a . . . Y . . . J . . . P . . .
[7ffff2a0]..[7ffff2a0] 7fffff38c 7fffff372 7fffff35f 7fffff33d a . . . Y . . . J . . . P . . .
[7ffff2b0]..[7ffff2b0] 7fffff318 7fffff306 00000000 00000000 a . . . Y . . . J . . . P . . .
```

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Memory and registers cleared

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