Lab Report

ECPE 170 – Computer Systems and Networks – Spring 2016

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

Lab Part 1 – Arithmetic
(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.

```
Int Regs [10]              □ ☒   Data                                                              □
PC       = 0                    User data segment [10000000]..[10040000]
EPC      = 0                    [10000000]..[1003ffff]  00000000
Cause    = 0
BadVAddr = 0
Status   = 805371664           User Stack [7ffff7f4]..[80000000]
                               [7ffff7f4]    0000000003  2147481846  2147481844              . . . . . . . . . . . . .
HI       = 0                    [7ffff800]    2147481829  0000000000  2147483625  2147483615   . . . . . . . . . . . . . . . .
LO       = 0                    [7ffff810]    2147483600  2147483585  2147483564  2147483535   . . . . . . . . . . . . . . . .
                               [7ffff820]    2147483520  2147483512  2147483496  2147483478   . . . . x . . . h . . . V . . .
R0  [r0] = 0                    [7ffff830]    2147483455  2147483408  2147483356  2147483346   ? . . . . . . . . . . . . . . .
R1  [at] = 0                    [7ffff840]    2147483286  2147483234  2147483201  2147483147   . . . . b . . . A . . . . . . .
R2  [v0] = 0                    [7ffff850]    2147483129  2147483103  2147483090  2147483071   . . . . . . . . . . . . . . . .
R3  [v1] = 0                    [7ffff860]    2147483020  2147483002  2147482958  2147482864   . . . . z . . . N . . . . . . .
R4  [a0] = 3                    [7ffff870]    2147482849  2147482832  2147482774  2147482743   . . . . . . . . . . . . w . . .
R5  [a1] = 2147481592          [7ffff880]    2147482732  2147482715  2147482689  2147482669   1 . . . [ . . . A . . . - . . .
R6  [a2] = 2147481608          [7ffff890]    2147482635  2147482587  2147482539  2147482523   . . . . . . . . . . . . . . . .
R7  [a3] = 0                    [7ffff8a0]    2147482505  2147482472  2147482419  2147482351   . . . . h . . . 3 . . . . . . .
R8  [t0] = 0                    [7ffff8b0]    2147482340  2147482322  2147482307  2147482285   . . . . . . . . . . . . . . . .
R9  [t1] = 0                    [7ffff8c0]    2147482217  2147482138  2147482129  2147482106   i . . . . . . . . . . . . . . .
R10 [t2] = 0                    [7ffff8d0]    2147482024  2147481959  2147481924  2147481898   . . . . g . . . D . . . * . . .
R11 [t3] = 0                    [7ffff8e0]    0000000000  1769095424  1701668980  0778266996   . . . . . . A r i t h m e t i c .
R12 [t4] = 0                    [7ffff8f0]    0007172961  1747910705  0795176303  2003137124   a s m . 1 . / h o m e / d r e w
R13 [t5] = 0                    [7ffff900]    1953063471  1801680226  0841970789  1597387056   / b i t b u c k e t / 2 0 1 6 _
R14 [t6] = 0                    [7ffff910]    1769107571  1700751214  0828731491  1815031863   s p r i n g _ e c p e 1 7 0 / l
R15 [t7] = 0                    [7ffff920]    0808542817  1918980143  1329791092  1514754125   a b 1 0 / P a r t . C O M P I Z
R16 [s0] = 0                    [7ffff930]    1313423967  1413566559  1966030152  1647276659   _ B I N _ P A T H = / u s r / b
R17 [s1] = 0                    [7ffff940]    0003108457  1599031623  1314210124  1145391171   i n / . G I O _ L A U N C H E D
R18 [s2] = 0                    [7ffff950]    1397048415  1347376203  1279870559  1230004037   _ D E S K T O P _ F I L E _ P I
R19 [s3] = 0                    [7ffff960]    0842218820  1191194674  1281314633  1129207105   D = 3 2 2 0 . G I O _ L A U N C
R20 [s4] = 0                    [7ffff970]    1598309704  1263748420  1599098708  1162627398   H E D _ D E S K T O P _ F I L E
R21 [s5] = 0                    [7ffff980]    1937059645  1752379250  0795177569  1819308129   = / u s r / s h a r e / a p p l
R22 [s6] = 0                    [7ffff990]    1952539497  1936617321  1937010991  0778922352   i c a t i o n s / q t s p i m .
R23 [s7] = 0                    [7ffff9a0]    1802724708  0007368564  1397966163  1598967625   d e s k t o p . S E S S I O N _
R24 [t8] = 0                    [7ffff9b0]    1095647565  1028801863  1633906540  1651847020   M A N A G E R = l o c a l / u b
R25 [t9] = 0                    [7ffff9c0]    1970564725  1949253690  0774860909  0759513929   u n t u : @ / t m p / . I C E -
R26 [k0] = 0                    [7ffff9d0]    2020175477  0959983919  1853172788  1966045289   u n i x / 1 8 9 4 , u n i x / u
R27 [k1] = 0                    [7ffff9e0]    1953396066  1949252213  0774860909  0759513929   b u n t u : / t m p / . I C E -
```

Int Regs [10]

```
PC        = 4194420
EPC       = 0
Cause     = 0
BadVAddr  = 0
Status    = 805371664

HI        = 0
LO        = 3

R0  [r0] = 0
R1  [at] = 268500992
R2  [v0] = 10
R3  [v1] = 0
R4  [a0] = 3
R5  [a1] = 2147481592
R6  [a2] = 2147481608
R7  [a3] = 0
R8  [t0] = 15
R9  [t1] = 10
R10 [t2] = 5
R11 [t3] = 2
R12 [t4] = 18
R13 [t5] = -3
R14 [t6] = 5
R15 [t7] = 10
R16 [s0] = 33
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 21
R25 [t9] = 3
R26 [k0] = 0
R27 [k1] = 0
```

Data

```
User data se        0000]..[10040000]
[10000000].    000ffff]     0000
[10010000]      0000000033      0000000    0000000000    0000000000    ! . . . . . . . . . . . . . .
[10010010].    1003ffff]   0    0000

User Stack [7ffff7f4]..[80000000]
[7ffff7f4]    0000000003    2147481846    2147481844                  . . . . . . . . . . . . . .
[7ffff800]    2147481829    0000000000    2147483625    2147483615    . . . . . . . . . . . . . . . .
[7ffff810]    2147483600    2147483585    2147483564    2147483535    . . . . . . . . . . . . . . . .
[7ffff820]    2147483520    2147483512    2147483496    2147483478    . . . . x . . . . h . . . V . . .
[7ffff830]    2147483455    2147483408    2147483356    2147483346    ? . . . . . . . . . . . . . . .
[7ffff840]    2147483286    2147483234    2147483201    2147483147    . . . . b . . . A . . . . . . .
[7ffff850]    2147483129    2147483103    2147483090    2147483071    . . . . . . . . . . . . . . . .
[7ffff860]    2147483020    2147483002    2147482958    2147482864    . . . . z . . . N . . . . . . .
[7ffff870]    2147482849    2147482832    2147482774    2147482743    . . . . . . . . . . . . w . . .
[7ffff880]    2147482732    2147482715    2147482689    2147482669    l . . . [ . . . A . . . - . . .
[7ffff890]    2147482635    2147482587    2147482539    2147482523    . . . . . . . . . . . . . . . .
[7ffff8a0]    2147482505    2147482472    2147482419    2147482351    . . . . h . . . 3 . . . . . . .
[7ffff8b0]    2147482340    2147482322    2147482307    2147482285    . . . . . . . . . . . . . . . .
[7ffff8c0]    2147482217    2147482138    2147482129    2147482106    i . . . . . . . . . . . . . . .
[7ffff8d0]    2147482024    2147481959    2147481924    2147481898    . . . . g . . . D . . . * . . .
[7ffff8e0]    0000000000    1769095424    1701668980    0778266996    . . . . . A r i t h m e t i c .
[7ffff8f0]    0007172961    1747910705    0795176303    2003137124    a s m . 1 . / h o m e / d r e w
[7ffff900]    1953063471    1801680226    0841970789    1597387056    / b i t b u c k e t / 2 0 1 6 _
[7ffff910]    1769107571    1700751214    0828731491    1815031863    s p r i n g _ e c p e 1 7 0 / l
[7ffff920]    0808542817    1918980143    1329791092    1514754125    a b 1 0 / P a r t . C O M P I Z
[7ffff930]    1313423967    1413566559    1966030152    1647276659    _ B I N _ P A T H = / u s r / b
[7ffff940]    0003108457    1599031623    1314210124    1145391171    i n / . G I O _ L A U N C H E D
[7ffff950]    1397048415    1347376203    1279870559    1230004037    _ D E S K T O P _ F I L E _ P I
[7ffff960]    0842218820    1191194674    1281314633    1129207105    D = 3 2 2 0 . G I O _ L A U N C
[7ffff970]    1598309704    1263748420    1599098708    1162627398    H E D _ D E S K T O P _ F I L E
[7ffff980]    1937059645    1752379250    0795177569    1819308129    = / u s r / s h a r e / a p p l
[7ffff990]    1952539497    1936617321    1937010991    0778922352    i c a t i o n s / q t s p i m .
[7ffff9a0]    1802724708    0007368564    1397966163    1598967625    d e s k t o p . S E S S I O N _
[7ffff9b0]    1095647565    1028801863    1633906540    1651847020    M A N A G E R = l o c a l / u b
[7ffff9c0]    1970564725    1949253690    0774860909    0759513929    u n t u : @ / t m p / . I C E -
```

Lab Part 2 – Branches

(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.

Int Regs [10]			Data

```
Int Regs [10]                Data

PC        = 0                User data segment [10000000]..[10040000]
EPC       = 0                [10000000]..[1000ffff]  00000000
Cause     = 0                [10010000]    0000000010  0000000015  0000000006  0000000000    . . . . . . . . . . . . . . . . .
BadVAddr  = 0                [10010010]..[1003ffff]  00000000
Status    = 805371664

HI        = 0                User Stack [7ffff7f4]..[80000000]
LO        = 0                [7ffff7f4]    0000000003  2147481846  2147481844                . . . . . . . . . . . .
                            [7ffff800]    2147481831  0000000000  2147483625  2147483615    . . . . . . . . . . . . . . . .
RO   [r0] = 0                [7ffff810]    2147483600  2147483585  2147483564  2147483535    . . . . . . . . . . . . . . . .
R1   [at] = 0                [7ffff820]    2147483520  2147483512  2147483496  2147483478    . . . . x . . . h . . . V . . .
R2   [v0] = 0                [7ffff830]    2147483455  2147483408  2147483356  2147483346    ? . . . . . . . . . . . . . . .
R3   [v1] = 0                [7ffff840]    2147483286  2147483234  2147483201  2147483147    . . . . b . . . A . . . . . . .
R4   [a0] = 3                [7ffff850]    2147483129  2147483103  2147483090  2147483071    . . . . . . . . . . . . . . . .
R5   [a1] = 2147481592       [7ffff860]    2147483020  2147483002  2147482958  2147482864    . . . . z . . . N . . . . . . .
R6   [a2] = 2147481608       [7ffff870]    2147482849  2147482832  2147482774  2147482743    . . . . . . . . . . . . . w . .
R7   [a3] = 0                [7ffff880]    2147482732  2147482715  2147482689  2147482669    l . . . [ . . . A . . . - . . .
R8   [t0] = 0                [7ffff890]    2147482635  2147482587  2147482539  2147482523    . . . . . . . . . . . . . . . .
R9   [t1] = 0                [7ffff8a0]    2147482505  2147482472  2147482419  2147482351    . . . . h . . . 3 . . . . . . .
R10  [t2] = 0                [7ffff8b0]    2147482340  2147482322  2147482307  2147482285    . . . . . . . . . . . . . . . .
R11  [t3] = 0                [7ffff8c0]    2147482217  2147482138  2147482129  2147482106    i . . . . . . . . . . . . . . .
R12  [t4] = 0                [7ffff8d0]    2147482024  2147481959  2147481924  2147481898    . . . . g . . . D . . . * . . .
R13  [t5] = 0                [7ffff8e0]    0000000000  1107296256  1668178290  0779314536    . . . . . . . . B r a n c h e s .
R14  [t6] = 0                [7ffff8f0]    0007172961  1747910706  0795176303  2003137124    a s m . 2 . / h o m e / d r e w
R15  [t7] = 0                [7ffff900]    1953063471  1801680226  0841970789  1597387056    / b i t b u c k e t / 2 0 1 6 _
R16  [s0] = 0                [7ffff910]    1769107571  1700751214  0828731491  1815031863    s p r i n g _ e c p e 1 7 0 / l
R17  [s1] = 0                [7ffff920]    0808542817  1918980143  1329791092  1514754125    a b 1 0 / P a r t . C O M P I Z
R18  [s2] = 0                [7ffff930]    1313423967  1413566559  1966030152  1647276659    _ B I N _ P A T H = / u s r / b
R19  [s3] = 0                [7ffff940]    0003108457  1599031623  1314210124  1145391171    i n / . G I O _ L A U N C H E D
R20  [s4] = 0                [7ffff950]    1397048415  1347376203  1279870559  1230004037    _ D E S K T O P _ F I L E _ P I
R21  [s5] = 0                [7ffff960]    0858996036  1191196214  1281314633  1129207105    D = 3 3 6 6 . G I O _ L A U N C
R22  [s6] = 0                [7ffff970]    1598309704  1263748420  1599098708  1162627398    H E D _ D E S K T O P _ F I L E
R23  [s7] = 0                [7ffff980]    1937059645  1752379250  0795177569  1819308129    = / u s r / s h a r e / a p p l
R24  [t8] = 0                [7ffff990]    1952539497  1936617321  1937010991  0778922352    i c a t i o n s / q t s p i m .
R25  [t9] = 0                [7ffff9a0]    1802724708  0007368564  1397966163  1598967625    d e s k t o p . S E S S I O N _
R26  [k0] = 0                [7ffff9b0]    1095647565  1028801863  1633906540  1651847020    M A N A G E R = l o c a l / u b
R27  [k1] = 0                [7ffff9c0]    1970564725  1949253690  0774860909  0759513929    u n t u : @ / t m p / . I C E -
```

Int Regs [10]

```
PC        = 4194504
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]  = 3
R5  [a1]  = 2147481592
R6  [a2]  = 2147481608
R7  [a3]  = 0
R8  [t0]  = 10
R9  [t1]  = 15
R10 [t2]  = 6
R11 [t3]  = -1
R12 [t4]  = 0
R13 [t5]  = 0
R14 [t6]  = 0
R15 [t7]  = 0
R16 [s0]  = 0
R17 [s1]  = 0
R18 [s2]  = 0
R19 [s3]  = 0
R20 [s4]  = 0
R21 [s5]  = 0
R22 [s6]  = 0
R23 [s7]  = 0
R24 [t8]  = 0
R25 [t9]  = 0
R26 [k0]  = 0
R27 [k1]  = 0
```

Data

```
User data segment [10000000]..[10040000]
[10000000]..[1000ffff]   00000000
[10010000]     0000000010  0000000015  0000000006                        -1        . . . . . . . . . . . .
[10010010]..[1003ffff]   00000000


User Stack [7ffff7f4]..[80000000]
[7ffff7f4]     0000000003  2147481846  2147481844                . . . . . . . . . . . . . . . .
[7ffff800]     2147481831  0000000000  2147483625  2147483615     . . . . . . . . . . . . . . . .
[7ffff810]     2147483600  2147483585  2147483564  2147483535     . . . . . . . . . . . . . . . .
[7ffff820]     2147483520  2147483512  2147483496  2147483478     . . . . x . . . h . . . V . . .
[7ffff830]     2147483455  2147483408  2147483356  2147483346     ? . . . . . . . . . . . . . . .
[7ffff840]     2147483286  2147483234  2147483201  2147483147     . . . . b . . . A . . . . . . .
[7ffff850]     2147483129  2147483103  2147483090  2147483071     . . . . . . . . . . . . . . . .
[7ffff860]     2147483020  2147483002  2147482958  2147482864     . . . . z . . . N . . . . . . .
[7ffff870]     2147482849  2147482832  2147482774  2147482743     . . . . . . . . . . . . w . . .
[7ffff880]     2147482732  2147482715  2147482689  2147482669     l . . . [ . . . A . . . - . . .
[7ffff890]     2147482635  2147482587  2147482539  2147482523     . . . . . . . . . . . . . . . .
[7ffff8a0]     2147482505  2147482472  2147482419  2147482351     . . . . h . . . 3 . . . . . . .
[7ffff8b0]     2147482340  2147482322  2147482307  2147482285     . . . . . . . . . . . . . . . .
[7ffff8c0]     2147482217  2147482138  2147482129  2147482106     i . . . . . . . . . . . . . . .
[7ffff8d0]     2147482024  2147481959  2147481924  2147481898     . . . . g . . . D . . . * . . .
[7ffff8e0]     0000000000  1107296256  1668178290  0779314536     . . . . . . . B r a n c h e s .
[7ffff8f0]     0007172961  1747910706  0795176303  2003137124     a s m . 2 . / h o m e / d r e w
[7ffff900]     1953063471  1801680226  0841970789  1597387056     / b i t b u c k e t / 2 0 1 6 _
[7ffff910]     1769107571  1700751214  0828731491  1815031863     s p r i n g _ e c p e 1 7 0 / l
[7ffff920]     0808542817  1918980143  1329791092  1514754125     a b 1 0 / P a r t . C O M P I Z
[7ffff930]     1313423967  1413566559  1966030152  1647276659     _ B I N _ P A T H = / u s r / b
[7ffff940]     0003108457  1599031623  1314210124  1145391171     i n / . G I O _ L A U N C H E D
[7ffff950]     1397048415  1347376203  1279870559  1230004037     _ D E S K T O P _ F I L E _ P I
[7ffff960]     0858996036  1191196214  1281314633  1129207105     D = 3 3 6 6 . G I O _ L A U N C
[7ffff970]     1598309704  1263748420  1599098708  1162627398     H E D _ D E S K T O P _ F I L E
[7ffff980]     1937059645  1752379250  0795177569  1819308129     = / u s r / s h a r e / a p p l
[7ffff990]     1952539497  1936617321  1937010991  0778922352     i c a t i o n s / q t s p i m .
[7ffff9a0]     1802724708  0007368564  1397966163  1598967625     d e s k t o p . S E S S I O N _
[7ffff9b0]     1095647565  1028801863  1633906540  1651847020     M A N A G E R = l o c a l / u b
[7ffff9c0]     1970564725  1949253690  0774860909  0759513929     u n t u : @ / t m p / . I C E -
```

Lab Part 3 – Loops

(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.

```
Int Regs [10]              Data

PC        = 0              User data segment [10000000]..[10040000]
EPC       = 0              [10000000]..[1000ffff]  00000000
Cause     = 0              [10010000]    0000000002  0000000000  0000000000  0000000000     . . . . . . . . . . . . . . . .
BadVAddr  = 0              [10010010]..[1003ffff]  00000000
Status    = 805371664

HI        = 0              User Stack [7ffff7f4]..[80000000]
LO        = 0              [7ffff7f4]    0000000003  2147481846  2147481844                 . . . . . . . . . . . . . . . .
                          [7ffff800]    2147481831  0000000000  2147483625  2147483615     . . . . . . . . . . . . . . . .
R0  [r0] = 0              [7ffff810]    2147483600  2147483585  2147483564  2147483535     . . . . . . . . . . . . . . . .
R1  [at] = 0              [7ffff820]    2147483520  2147483512  2147483496  2147483478     . . . . x . . . . h . . . . V . . .
R2  [v0] = 0              [7ffff830]    2147483455  2147483408  2147483356  2147483346     ? . . . . . . . . . . . . . . .
R3  [v1] = 0              [7ffff840]    2147483286  2147483234  2147483201  2147483147     . . . . b . . . A . . . . . .
R4  [a0] = 3             [7ffff850]    2147483129  2147483103  2147483090  2147483071     . . . . . . . . . . . . . . . .
R5  [a1] = 2147481592    [7ffff860]    2147483020  2147483002  2147482958  2147482864     . . . . z . . . N . . . . . .
R6  [a2] = 2147481608    [7ffff870]    2147482849  2147482832  2147482774  2147482743     . . . . . . . . . . . . . w . . . .
R7  [a3] = 0             [7ffff880]    2147482732  2147482715  2147482689  2147482669     l . . . [ . . . A . . . . - . . .
R8  [t0] = 0             [7ffff890]    2147482635  2147482587  2147482539  2147482523     . . . . . . . . . . . . . . . .
R9  [t1] = 0             [7ffff8a0]    2147482505  2147482472  2147482419  2147482351     . . . . h . . . 3 . . . . . .
R10 [t2] = 0             [7ffff8b0]    2147482340  2147482322  2147482307  2147482285     . . . . . . . . . . . . . . . .
R11 [t3] = 0             [7ffff8c0]    2147482217  2147482138  2147482129  2147482106     i . . . . . . . . . . . . . . .
R12 [t4] = 0             [7ffff8d0]    2147482024  2147481959  2147481924  2147481898     . . . . g . . . . D . . . * . . .
R13 [t5] = 0             [7ffff8e0]    0000000000  1107296256  1668178290  0779314536     . . . . . . . B r a n c h e s .
R14 [t6] = 0             [7ffff8f0]    0007172961  1747910706  0795176303  2003137124     a s m . 2 . / h o m e / d r e w
R15 [t7] = 0             [7ffff900]    1953063471  1801680226  0841970789  1597387056     / b i t b u c k e t / 2 0 1 6 _
R16 [s0] = 0             [7ffff910]    1769107571  1700751214  0828731491  1815031863     s p r i n g _ e c p e 1 7 0 / l
R17 [s1] = 0             [7ffff920]    0808542817  1918980143  1329791092  1514754125     a b 1 0 / P a r t . C O M P I Z
R18 [s2] = 0             [7ffff930]    1313423967  1413566559  1966030152  1647276659     _ B I N _ P A T H = / u s r / b
R19 [s3] = 0             [7ffff940]    0003108457  1599031623  1314210124  1145391171     i n / . G I O _ L A U N C H E D
R20 [s4] = 0             [7ffff950]    1397048415  1347376203  1279870559  1230004037     _ D E S K T O P _ F I L E _ P I
R21 [s5] = 0             [7ffff960]    0858996036  1191196214  1281314633  1129207105     D = 3 3 6 6 . G I O _ L A U N C
R22 [s6] = 0             [7ffff970]    1598309704  1263748420  1599098708  1162627398     H E D _ D E S K T O P _ F I L E
R23 [s7] = 0             [7ffff980]    1937059645  1752379250  0795177569  1819308129     = / u s r / s h a r e / a p p l
R24 [t8] = 0             [7ffff990]    1952539497  1936617321  1937010991  0778922352     i c a t i o n s / q t s p i m .
R25 [t9] = 0             [7ffff9a0]    1802724708  0007368564  1397966163  1598967625     d e s k t o p . S E S S I O N _
R26 [k0] = 0             [7ffff9b0]    1095647565  1028801863  1633906540  1651847020     M A N A G E R = l o c a l / u b
R27 [k1] = 0             [7ffff9c0]    1970564725  1949253690  0774860909  0759513929     u n t u : @ / t m p / . I C E -
```

Int Regs [10]

```
PC       = 4194432
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] = 3
R5  [a1] = 2147481592
R6  [a2] = 2147481608
R7  [a3] = 0
R8  [t0] = 77
R9  [t1] = -1
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 0
R25 [t9] = 0
R26 [k0] = 0
R27 [k1] = 0
```

Data

```
User data segment                    0]
[10000000]        11]   00000000
[10010000]        0000000077        -1  0000000000  0000000000    M . . . . . . . . . . . . . . .
[10010010]     1003ffff]   00000000


User Stack                    ]
[7ffff7f4]                2147481846  2147481844                  . . . . . . . . . . . . . . . .
[7ffff800]    2147481834  0000000000  2147483625  2147483615      . . . . . . . . . . . . . . . .
[7ffff810]    2147483600  2147483585  2147483564  2147483535      . . . . . . . . . . . . . . . .
[7ffff820]    2147483520  2147483512  2147483496  2147483478      . . . . x . . . h . . . V . . .
[7ffff830]    2147483455  2147483408  2147483356  2147483346      ? . . . . . . . . . . . . . . .
[7ffff840]    2147483286  2147483234  2147483201  2147483147      . . . . b . . . A . . . . . . .
[7ffff850]    2147483129  2147483103  2147483090  2147483071      . . . . . . . . . . . . . . . .
[7ffff860]    2147483020  2147483002  2147482958  2147482864      . . . . z . . . N . . . . . . .
[7ffff870]    2147482849  2147482832  2147482774  2147482743      . . . . . . . . . . . . . . w . .
[7ffff880]    2147482732  2147482715  2147482689  2147482669      l . . . [ . . . A . . . - . . .
[7ffff890]    2147482635  2147482587  2147482539  2147482523      . . . . . . . . . . . . . . . .
[7ffff8a0]    2147482505  2147482472  2147482419  2147482351      . . . . h . . . 3 . . . . . . .
[7ffff8b0]    2147482340  2147482322  2147482307  2147482285      . . . . . . . . . . . . . . . .
[7ffff8c0]    2147482217  2147482138  2147482129  2147482106      i . . . . . . . . . . . . . . .
[7ffff8d0]    2147482024  2147481959  2147481924  2147481898      . . . . g . . . D . . . * . . .
[7ffff8e0]    0000000000  1107296256  1867276658  0779317359      . . . . . . . B r a L o o p s .
[7ffff8f0]    0007172961  1747910707  0795176303  2003137124      a s m . 3 . / h o m e / d r e w
[7ffff900]    1953063471  1801680226  0841970789  1597387056      / b i t b u c k e t / 2 0 1 6 _
[7ffff910]    1769107571  1700751214  0828731491  1815031863      s p r i n g _ e c p e 1 7 0 / l
[7ffff920]    0808542817  1918980143  1329791092  1514754125      a b 1 0 / P a r t . C O M P I Z
[7ffff930]    1313423967  1413566559  1966030152  1647276659      _ B I N _ P A T H = / u s r / b
[7ffff940]    0003108457  1599031623  1314210124  1145391171      i n / . G I O _ L A U N C H E D
[7ffff950]    1397048415  1347376203  1279870559  1230004037      _ D E S K T O P _ F I L E _ P I
[7ffff960]    0858996036  1191196214  1281314633  1129207105      D = 3 3 6 6 . G I O _ L A U N C
[7ffff970]    1598309704  1263748420  1599098708  1162627398      H E D _ D E S K T O P _ F I L E
[7ffff980]    1937059645  1752379250  0795177569  1819308129      = / u s r / s h a r e / a p p l
[7ffff990]    1952539497  1936617321  1937010991  0778922352      i c a t i o n s / q t s p i m .
[7ffff9a0]    1802724708  0007368564  1397966163  1598967625      d e s k t o p . S E S S I O N _
[7ffff9b0]    1095647565  1028801863  1633906540  1651847020      M A N A G E R = l o c a l / u b
[7ffff9c0]    1970564725  1949253690  0774860909  0759513929      u n t u : @ / t m p / . I C E -
```

Lab Part 4 – Arrays

(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.

Int Regs [10]   ⊡⊠ Data

```
PC       = 0
EPC      = 0
Cause    = 0
BadVAddr = 0
Status   = 805371664

HI       = 0
LO       = 0

R0  [r0] = 0
R1  [at] = 0
R2  [v0] = 0
R3  [v1] = 0
R4  [a0] = 3
R5  [a1] = 2147481592
R6  [a2] = 2147481608
R7  [a3] = 0
R8  [t0] = 0
R9  [t1] = 0
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 0
R25 [t9] = 0
R26 [k0] = 0
R27 [k1] = 0
```

```
User data segment [10000000]..[10040000]
[10000000]..[10010013]  00000000
[10010014]    0000000001  0000000002  0000000003        . . . . . . . . . . . . .
[10010020]    0000000004  0000000005  0000000012  0000000000    . . . . . . . . . . . . . .
[10010030]..[1003ffff]  00000000


User Stack [7ffff7f4]..[80000000]
[7ffff7f4]    0000000003  2147481846  2147481844        . . . . . . . . . . . . .
[7ffff800]    2147481833  0000000000  2147483625  2147483615    . . . . . . . . . . . . . .
[7ffff810]    2147483600  2147483585  2147483564  2147483535    . . . . . . . . . . . . . .
[7ffff820]    2147483520  2147483512  2147483496  2147483478    . . . . x . . . h . . . V . . .
[7ffff830]    2147483455  2147483408  2147483356  2147483346    ? . . . . . . . . . . . . . . .
[7ffff840]    2147483286  2147483234  2147483201  2147483147    . . . . b . . . A . . . . . . .
[7ffff850]    2147483129  2147483103  2147483090  2147483071    . . . . . . . . . . . . . . . .
[7ffff860]    2147483020  2147483002  2147482958  2147482864    . . . . z . . . N . . . . . . .
[7ffff870]    2147482849  2147482832  2147482774  2147482743    . . . . . . . . . . . . . w . . .
[7ffff880]    2147482732  2147482715  2147482689  2147482669    l . . . [ . . . A . . . - . . .
[7ffff890]    2147482635  2147482587  2147482539  2147482523    . . . . . . . . . . . . . . . .
[7ffff8a0]    2147482505  2147482472  2147482419  2147482351    . . . . h . . . . 3 . . . . . . .
[7ffff8b0]    2147482340  2147482322  2147482307  2147482285    . . . . . . . . . . . . . . . .
[7ffff8c0]    2147482217  2147482138  2147482129  2147482106    i . . . . . . . . . . . . . . .
[7ffff8d0]    2147482024  2147481959  2147481924  2147481898    . . . . g . . . D . . . * . . .
[7ffff8e0]    0000000000  0000000000  1920090368  0779319649    . . . . . . . . . . A r r a y s .
[7ffff8f0]    0007172961  1747910708  0795176303  2003137124    a s m . 4 . / h o m e / d r e w
[7ffff900]    1953063471  1801680226  0841970789  1597387056    / b i t b u c k e t / 2 0 1 6 _
[7ffff910]    1769107571  1700751214  0828731491  1815031863    s p r i n g _ e c p e 1 7 0 / l
[7ffff920]    0808542817  1918980143  1329791092  1514754125    a b 1 0 / P a r t . C O M P I Z
[7ffff930]    1313423967  1413566559  1966030152  1647276659    _ B I N _ P A T H = / u s r / b
[7ffff940]    0003108457  1599031623  1314210124  1145391171    i n / . G I O _ L A U N C H E D
[7ffff950]    1397048415  1347376203  1279870559  1230004037    _ D E S K T O P _ F I L E _ P I
[7ffff960]    0858996036  1191196214  1281314633  1129207105    D = 3 3 6 6 . G I O _ L A U N C
[7ffff970]    1598309704  1263748420  1599098708  1162627398    H E D _ D E S K T O P _ F I L E
[7ffff980]    1937059645  1752379250  0795177569  1819308129    = / u s r / s h a r e / a p p l
[7ffff990]    1952539497  1936617321  1937010991  0778922352    i c a t i o n s / q t s p i m .
[7ffff9a0]    1802724708  0007368564  1397966163  1598967625    d e s k t o p . S E S S I O N _
[7ffff9b0]    1095647565  1028801863  1633906540  1651847020    M A N A G E R = l o c a l / u b
```

Int Regs [10]

PC	= 4194464
EPC	= 0
Cause	= 0
BadVAddr	= 0
Status	= 805371664
HI	= 0
LO	= 537001984
R0 [r0]	= 0
R1 [at]	= 0
R2 [v0]	= 10
R3 [v1]	= 0
R4 [a0]	= 3
R5 [a1]	= 2147481592
R6 [a2]	= 2147481608
R7 [a3]	= 0
R8 [t0]	= 0
R9 [t1]	= 3
R10 [t2]	= 268501012
R11 [t3]	= 537001988
R12 [t4]	= 12
R13 [t5]	= 0
R14 [t6]	= 21
R15 [t7]	= 33
R16 [s0]	= 0
R17 [s1]	= 0
R18 [s2]	= 0
R19 [s3]	= 0
R20 [s4]	= 0
R21 [s5]	= 0
R22 [s6]	= 0
R23 [s7]	= 0
R24 [t8]	= 0
R25 [t9]	= 0
R26 [k0]	= 0
R27 [k1]	= 0

Data

User Data Segment [10000000]..[10040000]

```
[10010000]    0537001984  0000000000  0000000000  0000000000    . . .  . . . . . . . . .
[10010010]    0000000000  0000000001  0000000002  0000000003    . . .  . . . . . . . . .
[10010020]    0000000004  0000000005  0000000012  0000000000    . . .  . . . . . . . . .
[10010030]..[1003ffff]    00000000
```

User Stack [7ffff7f4]..[80000000]

```
[7ffff7f4]    0000000003  2147481846  2147481844                . . . . . . . . . . .
[7ffff800]    2147481833  0000000000  2147483625  2147483615    . . . . . . . . . . . . .
[7ffff810]    2147483600  2147483585  2147483564  2147483535    . . . . . . . . . . . . .
[7ffff820]    2147483520  2147483512  2147483496  2147483478    . . . . x . . . h . . . V . . .
[7ffff830]    2147483455  2147483408  2147483356  2147483346    ? . . . . . . . . . . . . . . .
[7ffff840]    2147483286  2147483234  2147483201  2147483147    . . . . b . . . A . . . . . . .
[7ffff850]    2147483129  2147483103  2147483090  2147483071    . . . . . . . . . . . . . . . .
[7ffff860]    2147483020  2147483002  2147482958  2147482864    . . . . z . . . N . . . . . . .
[7ffff870]    2147482849  2147482832  2147482774  2147482743    . . . . . . . . . . . . w . . .
[7ffff880]    2147482732  2147482715  2147482689  2147482669    l . . . [ . . . A . . . - . . .
[7ffff890]    2147482635  2147482587  2147482539  2147482523    . . . . . . . . . . . . . . . .
[7ffff8a0]    2147482505  2147482472  2147482419  2147482351    . . . . h . . . 3 . . . . . . .
[7ffff8b0]    2147482340  2147482322  2147482307  2147482285    . . . . . . . . . . . . . . . .
[7ffff8c0]    2147482217  2147482138  2147482129  2147482106    i . . . . . . . . . . . . . . .
[7ffff8d0]    2147482024  2147481959  2147481924  2147481898    . . . . g . . . D . . . * . . .
[7ffff8e0]    0000000000  0000000000  1920090368  0779319649    . . . . . . . . . . A r r a y s .
[7ffff8f0]    0007172961  1747910708  0795176303  2003137124    a s m . 4 . / h o m e / d r e w
[7ffff900]    1953063471  1801680226  0841970789  1597387056    / b i t b u c k e t / 2 0 1 6 _
[7ffff910]    1769107571  1700751214  0828731491  1815031863    s p r i n g _ e c p e 1 7 0 / l
[7ffff920]    0808542817  1918980143  1329791092  1514754125    a b 1 0 / P a r t . C O M P I Z
[7ffff930]    1313423967  1413566559  1966030152  1647276659    _ B I N _ P A T H = / u s r / b
[7ffff940]    0003108457  1599031623  1314210124  1145391171    i n / . G I O _ L A U N C H E D
[7ffff950]    1397048415  1347376203  1279870559  1230004037    _ D E S K T O P _ F I L E _ P I
[7ffff960]    0858996036  1191196214  1281314633  1129207105    D = 3 3 6 6 . G I O _ L A U N C
[7ffff970]    1598309704  1263748420  1599098708  1162627398    H E D _ D E S K T O P _ F I L E
[7ffff980]    1937059645  1752379250  0795177569  1819308129    = / u s r / s h a r e / a p p l
[7ffff990]    1952539497  1936617321  1937010991  0778922352    i c a t i o n s / q t s p i m .
[7ffff9a0]    1802724708  0007368564  1397966163  1598967625    d e s k t o p . S E S S I O N _
```

Lab Part 5 – I/O, Loops, and Arrays

(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!)*

```
Int Regs [16]                    Data

PC        = 0                    User data segment [10000000]..[10040000]
EPC       = 0                    [10000000]..[10010003]  00000000
Cause     = 0                    [10010004]    61656c50  65206573  7265746e         P l e a s e   e n t e r
BadVAddr  = 0                    [10010010]    73206120  6e697274  00203a67  69727453    a   s t r i n g :   . S t r i
Status    = 3000ff10             [10010020]    6d20676e  68637461  0a00203a  00000000    n g   m a t c h :   . . . . . .
                                 [10010030]..[1003ffff]  00000000
HI        = 0
LO        = 0                    User Stack [7ffff7d8]..[80000000]
                                 [7ffff7d8]    00000006  7ffff8f6              . . . . . . . . .
R0  [r0]  = 0                    [7ffff7e0]    7ffff8f4  7ffff8f1  7ffff8eb  7ffff8e7    . . . . . . . . . . . . . . . .
R1  [at]  = 0                    [7ffff7f0]    7ffff8dc  00000000  7fffffe9  7ffffffdf   . . . . . . . . . . . . . . . .
R2  [v0]  = 0                    [7ffff800]    7ffffffd0 7fffffc1  7fffffac  7ffffff8f   . . . . . . . . . . . . . . . .
R3  [v1]  = 0                    [7ffff810]    7fffff80  7fffff78  7fffff68  7fffff56    . . . . x . . . h . . . V . . .
R4  [a0]  = 6                    [7ffff820]    7fffff3f  7fffff10  7ffffedc  7ffffed2    ? . . . . . . . . . . . . . . .
R5  [a1]  = 7ffff7dc             [7ffff830]    7ffffe96  7ffffe62  7ffffe41  7ffffe0b    . . . . b . . . . A . . . . . .
R6  [a2]  = 7ffff7f8             [7ffff840]    7ffffdf9  7ffffddf  7ffffdd2  7ffffdbf    . . . . . . . . . . . . . . . .
R7  [a3]  = 0                    [7ffff850]    7ffffd8c  7ffffd7a  7ffffd4e  7ffffcf0    . . . . z . . . N . . . . . . .
R8  [t0]  = 0                    [7ffff860]    7ffffce1  7ffffcd0  7ffffc96  7ffffc77    . . . . . . . . . . . . w . . .
R9  [t1]  = 0                    [7ffff870]    7ffffc6c  7ffffc5b  7ffffc41  7ffffc2d    l . . . [ . . . A . . . - . . .
R10 [t2]  = 0                    [7ffff880]    7ffffc0b  7ffffbdb  7ffffbab  7ffffb9b    . . . . . . . . . . . . . . . .
R11 [t3]  = 0                    [7ffff890]    7ffffb89  7ffffb68  7ffffb33  7ffffaef    . . . . h . . . 3 . . . . . . .
R12 [t4]  = 0                    [7ffff8a0]    7ffffae4  7ffffad2  7ffffac3  7ffffaad    . . . . . . . . . . . . . . . .
R13 [t5]  = 0                    [7ffff8b0]    7ffffa69  7ffffa1a  7ffffa11  7ffff9fa    i . . . . . . . . . . . . . . .
R14 [t6]  = 0                    [7ffff8c0]    7ffff9a8  7ffff967  7ffff944  7ffff92a    . . . . g . . . D . . . * . . .
R15 [t7]  = 0                    [7ffff8d0]    00000000  00000000  00000000  61727241    . . . . . . . . . . . . . A r r a
R16 [s0]  = 0                    [7ffff8e0]    612e7379  61006d73  4c00646e  73706f6f    y s . a s m . a n d . L o o p s
R17 [s1]  = 0                    [7ffff8f0]    004f4900  682f0035  2f656d6f  77657264    . I O . 5 . / h o m e / d r e w
R18 [s2]  = 0                    [7ffff900]    7469622f  6b637562  322f7465  5f363130    / b i t b u c k e t / 2 0 1 6 _
R19 [s3]  = 0                    [7ffff910]    69727073  655f676e  31657063  6c2f3037    s p r i n g _ e c p e 1 7 0 / 1
R20 [s4]  = 0                    [7ffff920]    30316261  7261502f  4f430074  5a49504d    a b 1 0 / P a r t . C O M P I Z
R21 [s5]  = 0                    [7ffff930]    4e49425f  5441505f  752f3d48  622f7273    _ B I N _ P A T H = / u s r / b
R22 [s6]  = 0                    [7ffff940]    002f6e69  5f4f4947  4e55414c  44454843    i n / . G I O _ L A U N C H E D
R23 [s7]  = 0                    [7ffff950]    5345445f  504f544b  4c49465f  49505f45    _ D E S K T O P _ F I L E _ P I
R24 [t8]  = 0                    [7ffff960]    33333d44  47003636  4c5f4f49  434e5541    D = 3 3 6 6 . G I O _ L A U N C
R25 [t9]  = 0                    [7ffff970]    5f444548  4b534544  5f504f54  454c4946    H E D _ D E S K T O P _ F I L E
R26 [k0]  = 0                    [7ffff980]    73752f3d  68732f72  2f657261  6c707061    = / u s r / s h a r e / a p p l
R27 [k1]  = 0
```

Int Regs [16]

PC	= 400080
EPC	= 0
Cause	= 0
BadVAddr	= 0
Status	= 3000ff10
HI	= 0
LO	= 0
R0 [r0]	= 0
R1 [at]	= 10010000
R2 [v0]	= a
R3 [v1]	= 0
R4 [a0]	= 8
R5 [a1]	= 7ffff7dc
R6 [a2]	= 7ffff7f8
R7 [a3]	= 0
R8 [t0]	= 8
R9 [t1]	= 0
R10 [t2]	= 8
R11 [t3]	= 0
R12 [t4]	= 0
R13 [t5]	= 0
R14 [t6]	= 0
R15 [t7]	= 0
R16 [s0]	= 0
R17 [s1]	= 0
R18 [s2]	= 0
R19 [s3]	= 0
R20 [s4]	= 0
R21 [s5]	= 0
R22 [s6]	= 0
R23 [s7]	= 0
R24 [t8]	= 1001002d
R25 [t9]	= 0
R26 [k0]	= 0
R27 [k1]	= 0

Data

```
User data segment [10000000]..[10040000]
[10000000]..[10010003]  00000000
[10010004]     736e6f63  746e6174  706f6e69          c o n s t a n t i n o p
[10010010]     000a656c  6e697274  00203a67  69727453  l e . . t r i n g :   . S t r i
[10010020]     6d20676e  68637461  0a00203a  00000000  n g   m a t c h :   . . . . . .
[10010030]..[1003ffff]  00000000


User Stack [7ffff7d8]..[80000000]
[7ffff7d8]     00000006  7ffff8f6                      . . . . . . . .
[7ffff7e0]     7ffff8f4  7ffff8f1  7ffff8eb  7ffff8e7  . . . . . . . . . . . . . . . .
[7ffff7f0]     7ffff8dc  00000000  7fffffe9  7fffffdf  . . . . . . . . . . . . . . . .
[7ffff800]     7ffffffd0  7fffffc1  7fffffac  7fffff8f  . . . . . . . . . . . . . . . .
[7ffff810]     7fffff80  7fffff78  7fffff68  7fffff56  . . . . x . . . h . . . V . . .
[7ffff820]     7fffff3f  7fffff10  7ffffedc  7ffffed2  ? . . . . . . . . . . . . . . .
[7ffff830]     7ffffe96  7ffffe62  7ffffe41  7ffffe0b  . . . . b . . . A . . . . . . .
[7ffff840]     7ffffdf9  7ffffddf  7ffffdd2  7ffffdbf  . . . . . . . . . . . . . . . .
[7ffff850]     7ffffd8c  7ffffd7a  7ffffd4e  7ffffcf0  . . . . z . . . N . . . . . . .
[7ffff860]     7ffffce1  7ffffcd0  7ffffc96  7ffffc77  . . . . . . . . . . . . w . . .
[7ffff870]     7ffffc6c  7ffffc5b  7ffffc41  7ffffc2d  l . . . [ . . . A . . - . . .
[7ffff880]     7ffffc0b  7ffffbdb  7ffffbab  7ffffb9b  . . . . . . . . . . . . . . . .
[7ffff890]     7ffffb89  7ffffb68  7ffffb33  7ffffaef  . . . . h . . . 3 . . . . . . .
[7ffff8a0]     7ffffae4  7ffffad2  7ffffac3  7ffffaad  . . . . . . . . . . . . . . . .
[7ffff8b0]     7ffffa69  7ffffa1a  7ffffa11  7ffff9fa  i . . . . . . . . . . . . . . .
[7ffff8c0]     7ffff9a8  7ffff967  7ffff944  7ffff92a  . . . . g . . . D . . . * . . .
[7ffff8d0]     00000000  00000000  00000000  61727241  . . . . . . . . . . . . A r r a
[7ffff8e0]     612e7379  61006d73  4c00646e  73706f6f  y s . a s m . a n d . L o o p s
[7ffff8f0]     004f4900  682f0035  2f656d6f  77657264  . I O . 5 . / h o m e / d r e w
[7ffff900]     7469622f  6b637562  322f7465  5f363130  / b i t b u c k e t / 2 0 1 6 _
[7ffff910]     69727073  655f676e  31657063  6c2f3037  s p r i n g _ e c p e 1 7 0 / l
[7ffff920]     30316261  7261502f  4f430074  5a49504d  a b 1 0 / P a r t . C O M P I Z
[7ffff930]     4e49425f  5441505f  752f3d48  622f7273  _ B I N _ P A T H = / u s r / b
[7ffff940]     002f6e69  5f4f4947  4e55414c  44454843  i n / . G I O _ L A U N C H E D
[7ffff950]     5345445f  504f544b  4c49465f  49505f45  _ D E S K T O P _ F I L E _ P I
[7ffff960]     33333d44  47003636  4c5f4f49  434e5541  D = 3 3 6 6 . G I O _ L A U N C
[7ffff970]     5f444548  4b534544  5f504f54  454c4946  H E D _ D E S K T O P _ F I L E
[7ffff980]     73752f3d  68732f72  2f657261  6c707061  = / u s r / s h a r e / a p p l
```

-All CodeIn BitBucket