

# Diep (Emma) Vu

## Lab 6 Report

### Description of arrsum.asm

The main program calls subroutine arrsum.asm to get the sum of the array. The subroutine first checks if the array size is 0 to exit the loop since there is an initial jump before entering the loop. This works better for the condition of array size of 0 since it saves a jump into the loop.

### Output for arrsum.asm

Console

Array sum: 2952

Int Regs [10]

PC = 4194336

EPC = 0

Cause = 0

BadVAddr = 0

Status = 805371664

HI = 0

LO = 0

R0 [r0] = 0

R1 [a1] = 0

R2 [v0] = 10

R3 [v1] = 0

R4 [a0] = 2952

R5 [a1] = 7

R6 [a2] = 2147483092

R7 [a3] = 0

R8 [t0] = 2952

R9 [t1] = 0

R10 [t2] = 961

R11 [t3] = 7

R12 [t4] = 0

R13 [t5] = 0

R14 [t6] = 268501028

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

R28 [gp] = 268468224

R29 [sp] = 2147483080

R30 [s8] = 0

R31 [ra] = 4194328

User data segment [10000000]..[10040000]

[10000000]..[1000ffff] 00000000

[10010000] 1634890305 1970479225 0002112109 -123 Array sum: . . . . .

[10010010] 0000000548 0000000923 0000000431 0000000560 \$. . . . . 0 . . . .

[10010020] -348 0000000961 0000000000 0000000000 . . . . .

[10010030]..[1003ffff] 00000000

User Stack [7ffffdc8]..[80000000]

[7ffffdc8] 0000000001 2147483154 . . . . .

[7ffffdd0] 0000000000 2147483636 2147483598 2147483576 . . . . .

[7ffffde0] 2147483512 2147483497 2147483462 2147483396 x . . . . F . . . . .

[7ffffdf0] 2147483301 2147483362 2147483324 2147483267 . . . . .

[7ffffe00] 2147483203 2147483189 0000000000 0000000000 C . . . . 5 . . . . .

[7ffffe10] 1429143552 1936876915 1701405743 0796227184 . . / Users / diepvu /

[7ffffe20] 0912417100 1835877677 1918971745 1836413810 Lab6 - Emma / arrsum

[7ffffe30] 1836278062 1129338880 1095517791 0809325383 . asm . X P C F L A G S = 0

[7ffffe40] 1476407416 1398752080 1230393925 1314866499 x 0 . X P C S E R V I C E \_ N

[7ffffe50] 1027951937 1819308129 1952539497 0778989417 A M E = a p p l i c a t i o n ,

[7ffffe60] 0778923875 1970430316 1953574515 1835626611 c o m . l a r u s . q t s p i m

[7ffffe70] 0892744494 0825439024 0909323825 0858992693 . 3 6 5 0 3 3 1 1 . 3 6 5 0 3 3

[7ffffe80] 1409299761 1229213773 1982807378 1714385505 1 5 . T M P D I R = / v a r / f

[7ffffe90] 1701088175 1647276914 2019700504 1785409657 o l d e r s / b h / b x y 0 k j

[7ffffea0] 1899311417 2020631409 2038051176 0959737972 9 1 5 q q c p x h 1 z y t p 4 9

[7ffffeb0] 0808477561 1852256304 0003101743 1178820447 y c 0 0 0 0 g n / T / \_ C F

[7ffffec0] 1163089247 1163157330 1163875416 1146045262 \_ U S E R \_ T E X T \_ E N C O D

[7ffffed0] 1028083273 1177647152 2016426549 2016426544 I N G = 0 x 1 F 5 : 0 x 0 : 0 x

[7ffffee0] 1330118704 0792544589 1919251285 1768173427 0 . H O M E = / U s e r s / d i

[7ffffef0] 1970096293 1162367744 0792546300 0795765090 e p v u . S H E L L = / b i n /

[7fffff00] 0006845306 1598575443 1213486401 1129272159 z s h . S S H \_ A U T H \_ S O C

[7fffff10] 1882144075 1635150194 1949263220 1664053357 K = / p r i v a t e / t m p / c

[7fffff20] 1630432623 1701605488 1969318958 1684562798 o m . a p p l e . l a u n c h d

[7fffff30] 0878326062 1381658232 0794900570 1953720652 . 1 2 4 x n Z R Z 8 a / L i s t

[7fffff40] 1919250021 1005762035 0792545364 0796029813 e n e r s \_ P A T H = / u s r /

[7fffff50] 0980314466 1852400175 1937059642 1651715954 b i n : / b i n : / u s r / s b

[7fffff60] 0792358505 1852400243 1196379136 1162690894 i n : / s b i n . L O G N A M E

[7fffff70] 1701405757 0007698032 1347635524 1029259596 = d i e p v u . D I S P L A Y =

[7fffff80] 1769107503 1702125942 1886221359 1836016431 / p r i v a t e / t m p / c o m

[7fffff90] 1806413102 1814979948 1668183393 1177445400 . a p p l e . l a u n c h d . F

[7fffffa0] 1278493804 1245132369 1919889201 1903701607 L 0 4 L Q 6 7 J 1 / o r g . x q

[7fffffb0] 1953653109 0003160698 1296912195 1598312001 u a r t z : 0 . C O M M A N D \_

[7fffffc0] 1162104653 1768846653 0808465016 1600061491 M O D E = u n i x 2 0 0 3 . \_

[7fffffd0] 1967277635 1701602414 1852138569 1768319348 C F B u n d l e I d e n t i f i

[7fffffe0] 1664971365 1814981999 1937076833 1937010990 e r = c o m . l a r u s . q t s

[7ffffff0] 0007170416 1380275029 1701405757 0007698032 p i m . U S E R = d i e p v u .

Kernel data segment [90000000]..[90010000]

[90000000] 2017796128 1953523043 0544108393 1668227072 E x c e p t i o n . . o c

[90000010] 1030183770 1630513085 1762373047 1010006320 C u s e r d a d . f a d .

### Description of `isort.asm`

The main program calls subroutine `isort.asm` to do insertion sort to an array. There's a pointer *i* and *j* saved in register `$t0`, `$t1`. Pointer *i* will go through the `outer_loop` starting from 1 and pointer *j* will go through the `inner_loop` starting from *i*.

I also had to extend the stack and preserve `$a0` because it gets overwritten many times in order to call `print_array` subroutine before and after `isort`

### Output for `isort.asm`



```
Here is the array before and after sorting:
-13, 5, -3, 20, 6
-13, -3, 5, 6, 20
|
```

## Before sorting:

FP Regs		Int Regs [10]		Data		Text	
Int Regs [10]						Data	
PC	= 0	User data segment [00000000]..[00040000]					
EPC	= 0	[10000000]..[000fffff] 00000000					
Cause	= 0	[10010000] 1701995848 0544434464 0543516788 1634890337				Here is the array	
BadVAddr	= 0	[10010010] 1700929657 1701998438 1684955424 1952866592				before and after	
Status	= 805371664	[10010020] 1931506277 1769239151 0540698478 0539754506				er sorting: ..,	
HI	= 0	[10010030] 0000002568 -13 0000000005 0000000000				.....	
LO	= 0	[10010040] 0000000020 0000000006 0000000000 0000000000				.....	
R0 [r0]	= 0	[10010050]..[0003ffff] 0000000000				.....	
R1 [a1]	= 0	User Stack [7ffffdc4]..[80000000]					
R2 [v0]	= 0	[7ffffdc4] 0000000002 2147483159 2147483150 2147483576				.....	
R3 [v1]	= 0	[7ffffdc0] 0000000000 2147483636 2147483598 2147483596				.....	
R4 [a0]	= 2	[7ffffdc0] 2147483381 2147483362 2147483324 2147483267				.....	
R5 [a1]	= 2147483000	[7ffffdc0] 2147483203 2147483189 0000000000 1868759040				C.....co	
R6 [a2]	= 2147483092	[7ffffdc0] 1630435696 0780571711 1919251285 1768173427				pysa.. /users /di	
R7 [a3]	= 0	[7ffffdc0] 1970696293 1650543663 1833250102 1764712813				evu / Lab6 - Ema / i	
R8 [t0]	= 0	[7ffffdc0] 1953656691 1129338880 1095517791 0809325383				sort. XPC. FLAG = 0	
R9 [t1]	= 0	[7ffffdc0] 1476407416 1396752080 1230393925 1314866499				x0, xPC = SERVICE_N	
R10 [t2]	= 0	[7ffffdc0] 1027951937 1813308129 1952539497 0778989417				AME = APPLICATION	
R11 [t3]	= 0	[7ffffdc0] 0778923875 1970430316 1953574515 1835626611				com. lar.us. qtp.im	
R12 [t4]	= 0	[7ffffdc0] 0892744494 0825439024 0909323825 0858992693				3.6503311.365033	
R13 [t5]	= 0	[7ffffdc0] 1409299761 1229213773 1962807378 1714385585				15. TMPDIR = var/f	
R14 [t6]	= 0	[7ffffdc0] 1701800175 1647276914 2019700584 1785409657				oldeer / bn / bxy0kj	
R15 [t7]	= 0	[7ffffdc0] 1899311417 2020631409 2038051176 0959737972				915qqcpxn1xyzp49	
R16 [s0]	= 0	[7ffffdc0] 0008477561 1852256304 0003101743 1178820447				yc0000ghn/T/..CF	
R17 [s1]	= 0	[7ffffdc0] 11530809247 1163157330 1163875416 1146045262				FTEXT. ENCOD	
R18 [s2]	= 0	[7ffffdc0] 1028083273 1177647152 2016426549 2016426544				FTEXT. ENCOD	
R19 [s3]	= 0	[7ffffdc0] 1330118704 0792544589 1919251285 1768173427				0. HOME = /users /di	
R20 [s4]	= 0	[7ffffdc0] 1970696293 1162367744 0792546380 0795765090				evs. SHELL = /bin /	
R21 [s5]	= 0	[7ffffdc0] 0006045306 1590575403 1213406401 1129272159				zsh. SHERAUTH. SO C	
R22 [s6]	= 0	[7ffffdc0] 1882144075 1635150194 1949263220 1664053357				cp / private / tmp / c	
R23 [s7]	= 0	[7ffffdc0] 1630432623 1701605488 1969318958 1684562798				om. apple. launchd	
R24 [t8]	= 0	[7ffffdc0] 0078326062 1381658232 0794900570 1953728652				1.24xNZR28a / List	
R25 [t9]	= 0	[7ffffdc0] 1919250021 1095762035 0792545364 0796020813				eners. PATH = /usr /	
R26 [k0]	= 0	[7ffffdc0] 0908031466 1852400175 1937859642 1651715954				bin: / bin / user / sb	
R27 [k1]	= 0	[7ffffdc0] 0792358585 1852400243 1196379136 1162690894				in: / bin / LOGNAME	
R28 [gp]	= 268468224	[7ffffdc0] 1701805757 0007690832 1347635524 1829259596				di. evu. DISPLAY =	
R29 [sp]	= 2147483076	[7ffffdc0] 1769107503 1762125942 1886221359 1836016431				eners. z.0. CPMAN	
R30 [s8]	= 0	[7ffffdc0] 1886413102 1814979948 1668183393 1177445480				apple. launchd. F	
R31 [ra]	= 0	[7ffffdc0] 1278493804 1245132369 1919889201 1903701607				LO4L06731 / org. xq	
		[7ffffdc0] 1953653109 0003160698 1226912195 1598312001				MODE. UENCODE.003	
		[7ffffdc0] 1162104653 1768046653 0808465016 1600061491				MODE. UENCODE.003	
		[7ffffdc0] 1967277635 1701602414 1852138569 1768319348				CFBundleIdentit	
		[7ffffdc0] 1664971365 1814981999 1937076833 1937010990				F = com. lar.us. qtp	
		[7ffffdc0] 0007170416 1306275029 1701405757 0007690832				p.im. UENCODE.003	
		Kernel data segment [00000000]..[00010000]					

## After sorting:

FP Regs		Int Regs [10]		Data		Text	
Int Regs [10]				Data			
PC	= 4194336	User data segment [00000000]..[00040000]					
EPC	= 0	[10000000]..[000fffff] 00000000					
Cause	= 0	[10010000] 1701995846 0544434464 0543516788 1634890337		Here is the array			
BadVAddr	= 0	[10010010] 1700929657 1701998438 1684955424 1952866592		before and after			
Status	= 805371664	[10010020] 1931506277 1769239151 0540698478 0539754506		sorting: ..			
		[10010030] 0000002560 -13 -3 0000000005		.....			
HI	= 0	[10010040] 0000000005 0000000020 0000000000 0000000000		.....			
LO	= 0	[10010050]..[0003ffff] 0000000000		.....			
		User Stack [7ffffdc4]..[80000000]					
R0 [r0]	= 0	[7ffffdc4] 0000000002 2147483159 2147483150		.....			
R1 [a1]	= 268500992	[7ffffdc0] 0000000000 2147483636 2147483598 2147483576		.....			
R2 [v0]	= 18	[7ffffdc0] 2147483512 2147483497 2147483462 2147483396		.....			
R3 [v1]	= 0	[7ffffdc0] 2147483381 2147483362 2147483324 2147483267		.....			
R4 [a0]	= 268501041	[7ffffdc0] 2147483203 2147483189 0000000000 1868759040		.....			
R5 [a1]	= 5	[7ffffdc0] 1630435696 0780571711 1919251285 1768173427		.....			
R6 [a2]	= 2147483092	[7ffffdc0] 1970696293 1650543663 1833250102 1764712813		.....			
R7 [a3]	= 0	[7ffffdc0] 1953656691 1129338880 1095517791 0809325383		.....			
R8 [t0]	= 268501064	[7ffffdc0] 1476407416 1398752080 1230393925 1314866499		.....			
R9 [t1]	= 0	[7ffffdc0] 1027951937 1815308129 1952539497 0778989417		.....			
R10 [t2]	= 268501038	[7ffffdc0] 0778923875 1970430316 1953574515 1835626611		.....			
R11 [t3]	= 268501041	[7ffffdc0] 0892744494 0825439024 0909323825 0858992693		.....			
R12 [t4]	= 5	[7ffffdc0] 1409299761 1229213773 1962807378 1714385585		.....			
R13 [t5]	= 0	[7ffffdc0] 1701800175 1647276914 2019700584 1785409657		.....			
R14 [t6]	= 268501060	[7ffffdc0] 1899311417 2020631409 2038051176 0959737972		.....			
R15 [t7]	= 268501052	[7ffffdc0] 0008477561 1852256304 0003101743 1178820447		.....			
R16 [s0]	= 0	[7ffffdc0] 1153080924 1163157330 1163875416 1146045262		.....			
R17 [s1]	= 0	[7ffffdc0] 1028083273 1177647152 2016426549 2016426544		.....			
R18 [s2]	= 0	[7ffffdc0] 1330118704 0792544589 1919251285 1768173427		.....			
R19 [s3]	= 0	[7ffffdc0] 1970696293 1162367744 0792546380 0795765090		.....			
R20 [s4]	= 0	[7ffffdc0] 0006045306 1598575403 1213406401 1129272159		.....			
R21 [s5]	= 0	[7ffffdc0] 1882144075 1635150194 1949263220 1664053357		.....			
R22 [s6]	= 0	[7ffffdc0] 1630432623 1701605488 1969318958 1684562798		.....			
R23 [s7]	= 0	[7ffffdc0] 0078326062 1381658232 0794900570 1953720652		.....			
R24 [t8]	= 0	[7ffffdc0] 1919250021 1095762035 0792545364 0796020813		.....			
R25 [t9]	= 0	[7ffffdc0] 0908031466 1852400175 1937059642 1651715954		.....			
R26 [k0]	= 0	[7ffffdc0] 0792358585 1852400243 1196379136 1162690894		.....			
R27 [k1]	= 0	[7ffffdc0] 1701805757 0007690832 1347635524 1829259596		.....			
R28 [gp]	= 268468224	[7ffffdc0] 1769107503 1762125942 1886221359 1836016431		.....			
R29 [sp]	= 2147483076	[7ffffdc0] 1886413102 1814979948 1668183393 1177445480		.....			
R30 [s8]	= 0	[7ffffdc0] 1278493804 1245132369 1919889201 1903701607		.....			
R31 [ra]	= 4194328	[7ffffdc0] 1953653109 0003160698 1226912195 1598312001		.....			
		[7ffffdc0] 1162104653 1768046653 0808465016 1600061491		.....			
		[7ffffdc0] 1967277635 1701602414 1852138569 1768319348		.....			
		[7ffffdc0] 1664971365 1814981999 1937076833 1937010990		.....			
		[7ffffdc0] 0007170416 1306275029 1701405757 0007690832		.....			
		Kernel data segment [00000000]..[00010000]					