

Final presentation

Team 10

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Phase 1 (C code)

- Construct C file with dynamic programming(memoization)
 - Use **bit masking** to check where we have been visiting
 - **Memoize** the distance from the visited place to next place: must store **ALL** information
- However, we modified to more efficient recursion
 - Original algorithm is replaced by **Tail recursion**
 - Rather than using large-size array, update whenever the optimal is changed

Problem at Phase 2

- Problem of the first trial
 - Arithmetic **overflow, bad address** exception
 - **Runtime error** was shown
- How to solve at phase 3
 - Add the **distance calculation** code manually
 - Remove dynamic allocation; **Just declare array**
 - Use of **float** data, rather than double
 - Use **more registers**

Phase 3 improvements

- Use of **float**, rather than **double**
 - Can use **simpler** instruction, and **less memory** space
- Use **register evenly**
 - Registers are used as **cache**, so can **reduce memory access** and the **number of instructions**
- **Calculate distance manually**
 - Use **sqrt.s instruction** rather than sqrt function, replace pow function as **multiplication**
 - Available when the place of cities are changed
- **Total instruction: 66350**

| Text Segment | | | |
|--------------------------|---------|------------------------------|--------------------------------|
| Bkpt | Address | Code | Basic |
| <input type="checkbox"/> | 4194304 | 0x24150000 addiu \$21,\$0,0 | 30: li \$s5, 0 #i |
| <input type="checkbox"/> | 4194308 | 0x08100003 j 4194316 | 31: j cal_dist |
| <input type="checkbox"/> | 4194312 | 0x00000000 nop | 32: nop |
| <input type="checkbox"/> | 4194316 | 0x22b50001 addi \$21,\$21,1 | 35: addi \$s5, \$s5, 1 |
| <input type="checkbox"/> | 4194320 | 0x00000000 nop | 36: nop |
| <input type="checkbox"/> | 4194324 | 0x20010007 addi \$1,\$0,7 | 38: beq \$s5, 7, call_tsp |
| <input type="checkbox"/> | 4194328 | 0x1035003b beq \$1,\$21,59 | |
| <input type="checkbox"/> | 4194332 | 0x00000000 nop | 39: nop |
| <input type="checkbox"/> | 4194336 | 0x24160000 addiu \$22,\$0,0 | 41: li \$s6, 0 |
| <input type="checkbox"/> | 4194340 | 0x00000000 nop | 42: nop |
| <input type="checkbox"/> | 4194344 | 0x02b6082a sit \$1,\$21,\$22 | 45: bgt \$s6, \$s5, cal_dist |
| <input type="checkbox"/> | 4194348 | 0x1420fff7 bne \$1,\$0,-9 | |
| <input type="checkbox"/> | 4194352 | 0x00000000 nop | 46: nop |
| <input type="checkbox"/> | 4194356 | 0x3c011001 lui \$1,4097 | 47: la \$t0, cities #cities t0 |
| <input type="checkbox"/> | 4194360 | 0x34280000 ori \$8,\$1,0 | |
| <input type="checkbox"/> | 4194364 | 0x00000000 nop | 48: nop |

| Data Segment | | | | | | | | |
|--------------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|
| Address | Value (+0) | Value (+4) | Value (+8) | Value (+12) | Value (+16) | Value (+20) | Value (+24) | Value (+28) |
| 268500992 | 0 | 0 | 8 | 6 | 2 | 4 | 6 | 7 |
| 268501024 | 1 | 3 | 9 | 4 | 2 | 3 | 1103355325 | 0 |
| 268501056 | 1092616192 | 1083120573 | 1091797825 | 1078616770 | 1092457708 | 1080475994 | 1092616192 | 0 |
| 268501088 | 1087005378 | 1074731965 | 1089713258 | 1074731965 | 1087809947 | 1083120573 | 1087005378 | 0 |
| 268501120 | 1084227584 | 1068827891 | 1088421888 | 1065353216 | 1091797825 | 1074731965 | 1084227584 | 0 |
| 268501152 | 1087170149 | 1082639286 | 1085605107 | 1078616770 | 1089713258 | 1068827891 | 1087170149 | 0 |
| 268501184 | 1090584322 | 1065353216 | 1092457708 | 1074731965 | 1088421888 | 1082639286 | 1090584322 | 0 |
| 268501216 | 1088570928 | 1080475994 | 1087809947 | 1065353216 | 1085605107 | 1065353216 | 1088570928 | 0 |
| 268501248 | 1 | 6 | 5 | 4 | 7 | 7 | 7 | 1 |
| 268501280 | 6 | 2 | 4 | 3 | 7 | 5 | 1 | 1953720644 |
| 268501312 | 1701015137 | 2112032 | 1752457552 | 544434464 | 536879162 | 2560 | 0 | 0 |
| 268501344 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 268501376 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 268501408 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 268501440 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

0x10010000 (.data) Hexadecimal Addresses Hexadecimal Values ASCII

Mars Messages Run I/O

Distance : 24.48327
Path is : 1 6 2 4 3 7 5 1
-- program is finished running --

Clear

Run speed at max (no interaction)

Instruction Counter, Version 1.0 (Felipe Lessa)

Counting the number of instructions executed

Instructions so far: 66350

R-type: 24072 36%

I-type: 41111 61%

J-type: 1167 1%

Tool Control

Disconnect from MIPS Reset Close

| Registers | | | Coproc 1 | Coproc 0 |
|-----------|--------|------------|----------|----------|
| Name | Number | Value | | |
| \$zero | 0 | 0 | | |
| \$at | 1 | 8 | | |
| \$v0 | 2 | 10 | | |
| \$v1 | 3 | 0 | | |
| \$a0 | 4 | 268501331 | | |
| \$a1 | 5 | 0 | | |
| \$a2 | 6 | 1 | | |
| \$a3 | 7 | 0 | | |
| \$t0 | 8 | 268501276 | | |
| \$t1 | 9 | 8 | | |
| \$t2 | 10 | 268501304 | | |
| \$t3 | 11 | 268501300 | | |
| \$t4 | 12 | 2 | | |
| \$t5 | 13 | 3 | | |
| \$t6 | 14 | 3 | | |
| \$t7 | 15 | 0 | | |
| \$s0 | 16 | 7 | | |
| \$s1 | 17 | 64 | | |
| \$s2 | 18 | 7 | | |
| \$s3 | 19 | 3 | | |
| \$s4 | 20 | 0 | | |
| \$s5 | 21 | 7 | | |
| \$s6 | 22 | 7 | | |
| \$s7 | 23 | 0 | | |
| \$t8 | 24 | 12 | | |
| \$t9 | 25 | 268501048 | | |
| \$k0 | 26 | 0 | | |
| \$k1 | 27 | 0 | | |
| \$gp | 28 | 268468224 | | |
| \$sp | 29 | 2147479548 | | |
| \$fp | 30 | 0 | | |
| \$ra | 31 | 4194684 | | |
| pc | | 4194696 | | |
| hi | | 0 | | |
| lo | | 0 | | |

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