

Binary Instrumentation with PIN

Steps should be followed to run the codes for this assignment:

- 1) Install and set up PIN. Linux system was preferred for this assignment.
- 2) Open terminal and run following commands:
`set /pin-3.15-98253-gb56e429b1-gcc-linux/intel64/lib/libpinjitprofiling.so`
`cd pin-3.15-98253-gb56e429b1-gcc-linux/source/tools/ManualExamples`
You need to write your own path of folder.
- 3) Compile `iterative.c` and `recursive.c` files and get output files like `a.out`
- 4) Copy those output files to `ManualExamples` folder
- 5) Run following commands:
`make bonushomework.test`
`../../pin -t obj-intel64/bonushomework.so -- ./a.out`
- 6) Enter input and then check file called as `bonusHWoutput.out` to see output.

TASK 1

For task 1, firstly, the instruction type is checked. If it is a branch instruction, the situation of it checked with `INS_HasFallThrough` function to control if it is taken or not taken. Then `calculatePredictions` function is implemented to check correctness of predictions. If it is taken and predicted as a taken or it is not taken and predicted as not taken the variable called as `predictedcorrectly` is increased. In other conditions, wrong predictions, the variable called as `predictedincorrectly` is increased. `IARG_BRANCH_TAKEN` is used.

TASK 2

For task 2, firstly, type of instructions is checked with `INS_IsMemoryWrite` and `INS_IsMemoryRead`. After this control, to measure the total size of memory operations `INS_MemoryWriteSize` and `INS_MemoryReadSize` functions is used. For every memory operation `sizeofmem` variable is increased by results of those functions. Then, count of read memory operations is calculated to measure the ratio of read operations.

TASK 3

For task 3, variables to keep the frequency of usage of each register as a destination register created for each register. Then, the destination register is found with `INS_RegW` function. After that, the name of the register is found with `REG_StringShort` function. Name of the registers are compared and counters to keep frequencies are increasing according to name of register. For more details, `bonushomework.cpp` file can be checked.

Code for each task is included in `bonushomework.cpp` as separated by command lines.
Iterative and recursive versions of factorial function were used to test.

Example outputs for iterative version of factorial function:

For 6! :

Task 1:

Total count of branches: 39791

Count of branches predicted correctly: 22829

Count of branches predicted incorrectly: 16962

Accuracy of branch prediction: 57.3723%

Task 2:

Total size of memory operations: 44538B

Ratio of read operations: 61.2019%

Task 3:

RAX: 1347

RBX: 334

RCX: 395

RDX: 679

RSI: 415

RDI: 483

RSP: 618

RBP: 218

R8: 92

R9: 82

R10: 106

R11: 40

R12: 217

R13: 154

R14: 137

R15: 151

COMP 305 Computer Organization Fall 2020
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Bonus Homework
Due Date: 27th January 2021 – 23:59

Student Name: Melike Doğru
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For 12! :

Task 1:

Total count of branches: 39828

Count of branches predicted correctly: 22843

Count of branches predicted incorrectly: 16985

Accuracy of branch prediction: 57.3541%

Task 2:

Total size of memory operations: 44525B

Ratio of read operations: 61.2157%

Task 3:

RAX: 1347

RBX: 334

RCX: 395

RDX: 679

RSI: 415

RDI: 482

RSP: 618

RBP: 218

R8: 92

R9: 82

R10: 106

R11: 40

R12: 217

R13: 154

R14: 137

R15: 151

Example outputs for recursive version of factorial function:

For 6! :

Task 1:

Total count of branches: 39810

Count of branches predicted correctly: 22846

Count of branches predicted incorrectly: 16964

Accuracy of branch prediction: 57.3876%

Task 2:

Total size of memory operations: 44708B

Ratio of read operations: 61.21%

Task 3:

RAX: 1357

RBX: 337

RCX: 397

RDX: 682

RSI: 417

RDI: 484

RSP: 623

RBP: 221

R8: 94

R9: 82

R10: 106

R11: 41

R12: 220

R13: 155

R14: 138

R15: 154

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For 12! :

Task 1:

Total count of branches: 39847

Count of branches predicted correctly: 22860

Count of branches predicted incorrectly: 16987

Accuracy of branch prediction: 57.3694%

Task 2:

Total size of memory operations: 44695B

Ratio of read operations: 61.2238%

Task 3:

RAX: 1357

RBX: 337

RCX: 397

RDX: 682

RSI: 417

RDI: 483

RSP: 623

RBP: 221

R8: 94

R9: 82

R10: 106

R11: 41

R12: 220

R13: 155

R14: 138

R15: 154