Report for optimization results

In this report, we will take inlining and unrolling as examples to explore the optimization effects of our compiler(all other optimizations are closed).

Modified compiler usage

Now `-O` option has to match a `3`-bit string. The bits denotes `3` types of optimizations we used in this experiment:

`O3 function-inlining   function-merge`

For example `-O 001` means only inlining is enabled.

O3(1xx)

To mention that if we enable `O3` for our program, we can get a boost of speed up(~`4`x) but the compilation time is also extended largely(~`60`x).

Inlining(010)

sample input program

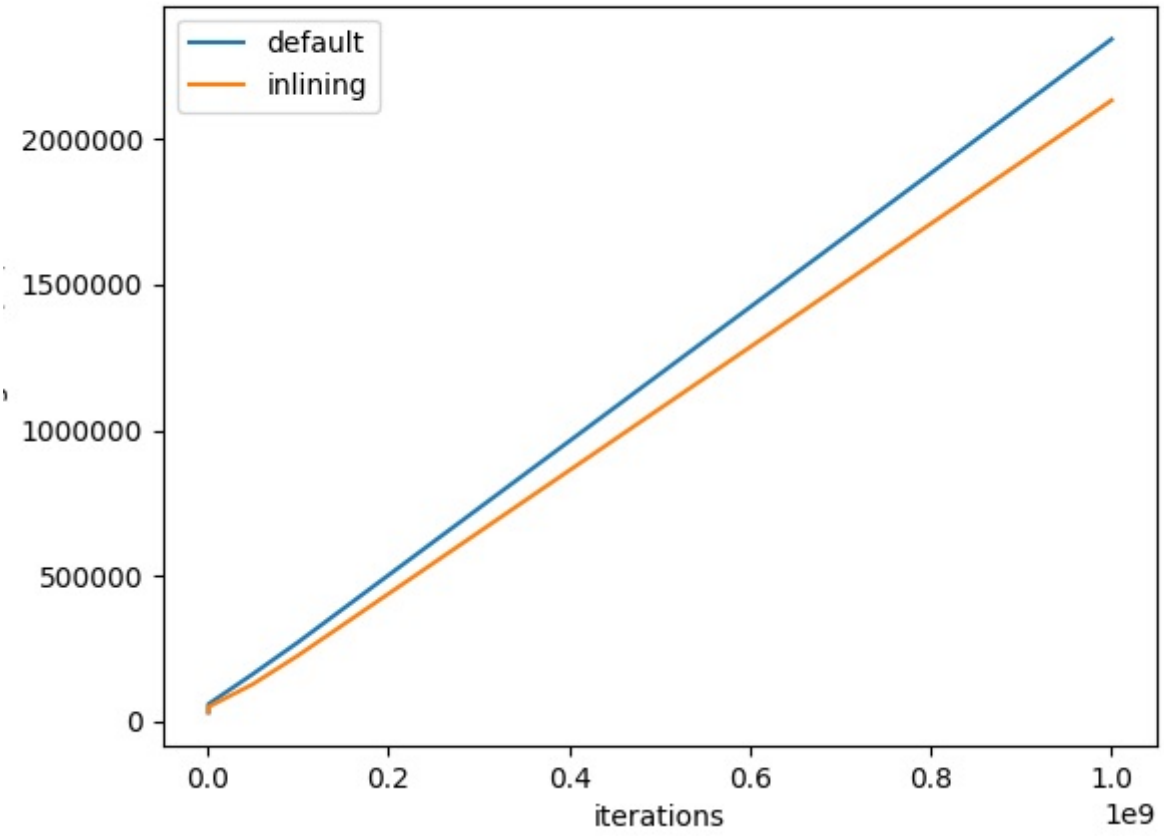
```
def void increase(ref int $a){
    $a = $a + 1;
}

def int run(){
  int $a = 1;
  while($a < N){
    increase($a);
  }
  return 0;
}
```

compiler-time peroformance

(Note: to get rid of randomness, all timings used in this report are averaged from `5` runnings.) The compiler time changes from `227`us to `489`us. When looking at the IR code, we can find the size of `increase` is almost the same as `run`. So to inline the increase function, the inlining pass actually modifies the IR a lot.

run-time performance

We change the iteration limits and draw a iter-timing graph shown in below:



When iteration time is large, inlined version can gain a speed up about 10～15%. However when iteration number is really small, the inlined version loose its advantage due to the overhead at function(`run`) initialization.

mergeFunctions(001)

When some identical instruction appears in compiler, we can merge them to one function and avoid unneccessary computations.

sample input program

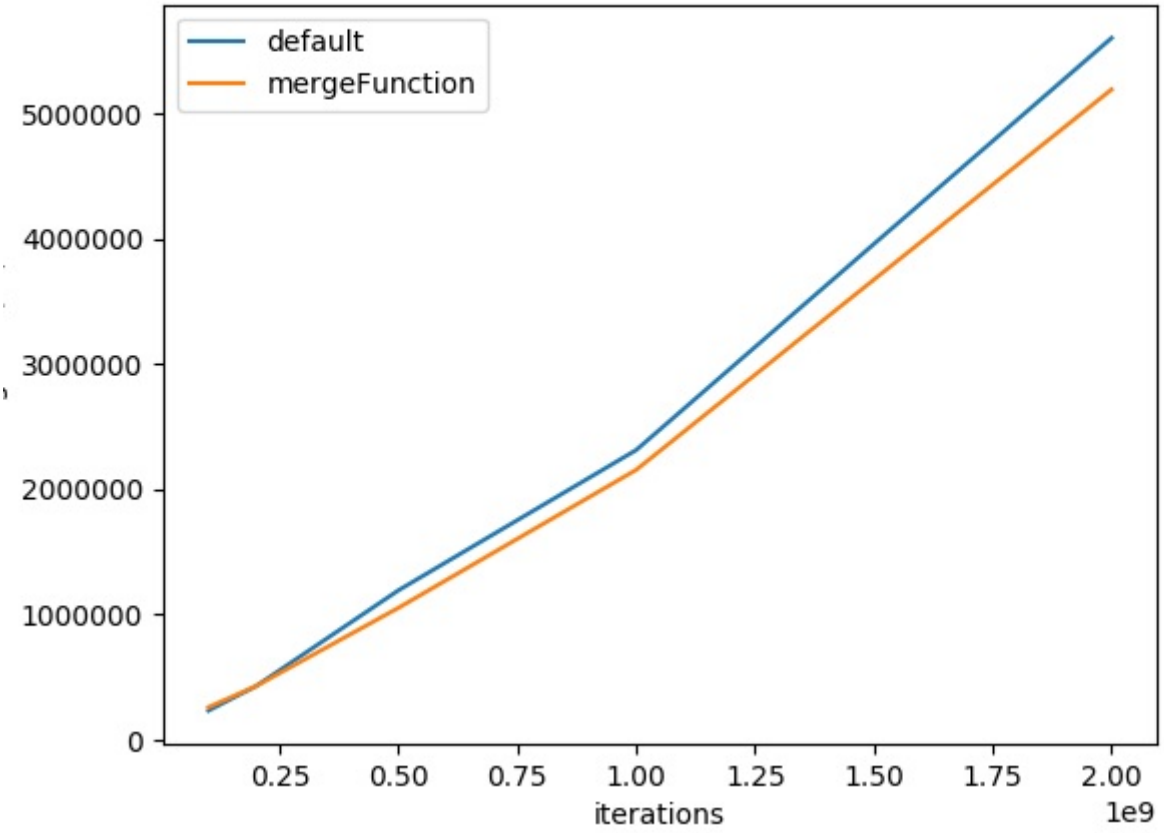
```
def int run(){
  int $a = 1;
  int $b = 2;
  int $c = 3;
  int $d = 4;
  while($a < N){
    $d = $b + $c;
    $d = $b + $c;
    $a = $a + 1;
  }
  return 0;
}
```

compiler-time peroformance

The compiler time changes from 224us to 331us. Compared to inlining, mergeFunction modifies the IR less and do not enlarge IR.

run-time performance

Also, we change the iteration times for while loop.



Since we have 2 identical add instructions but not 2 large functions, the merge over head seems very large, but at least we can still observe some speed up for this experiments.