Homework 4
COSE312, Spring 2023

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Due: 05/17, 23:59

The goal of this assignment is to implement an optimizer for SPVM programs. The template code is available at

`https://github.com/kupl-courses/COSE312-2023spring/tree/main/homework/hw4`

Your job is to implement the `optimize` function in `optimizer.ml`:

```
optimize :  Spvm.program -> Spvm.program
```

which takes an SPVM program and produces an optimized yet semantically-equivalent program. Submit `optimizer.ml` only. Do not modify any files in the template code except for `optimizer.ml`.

For example, the SPY program

```
def fact(n):
  i = 1
  r = 1
  while i <= n:
      r *= i
      i += 1
  return r

def factorial(n): return fact(n)

print(factorial(10))
```

gets translated into the SPVM program

```
24 : def fact(n)
     3 : .t1 = 1
     4 : i = .t1
     5 : .t2 = 1
     6 : r = .t2
     7 : SKIP
     9 : .t4 = i
    10 : .t5 = n
    11 : .t3 = .t4 <= .t5
    21 : iffalse .t3 goto 8
    12 : .t7 = r
    13 : .t8 = i
    14 : .t6 = .t7 * .t8
    15 : r = .t6
    16 : .t10 = i
    17 : .t11 = 1
```

```
    18 : .t9 = .t10 + .t11
    19 : i = .t9
    20 : goto 7
     8 : SKIP
    22 : .t12 = r
    23 : return .t12

29 : def factorial(n)
    25 : .t14 = fact
    26 : .t15 = n
    27 : .t13 := call(.t14, (.t15))
    28 : return .t13

30 : .t18 = factorial
31 : .t19 = 10
32 : .t17 := call(.t18, (.t19))
33 : .t20 = " "
35 : write .t17
34 : write .t20
36 : .t21 = "\n"
37 : write .t21
38 : .t16 = None
2 : HALT
```

which is executed by the SPVM interpreter to obtain the result:

```
3628800
The number of instructions executed : 168
```

Your goal is to minimize the number of instructions executed shown above while producing the same output as the original program.