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Advanced Programming (CO2039)

Report (Semester 202, Duration: 01 weeks)

OOP vs FP

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1 OOP and FP in baking a pizza

OOP makes code understandable by encapsulating moving parts. FP makes code understandable by minimizing moving parts.

What? Alright that sounds a bit rough, let's rephrase this a bit. OOP aims to model the world in self-contained entities, and affects change by modifying the state of itself or other entities. FP on the other hand aims to not modify the original data, but rather creates new data given some existing data.

To demonstrate this, we will try to make a pizza. With OOP, a big box or object with all the materials to create a pizza is available, and the helper methods will slowly transform them into a complete pizza. FP will take a different approach, as materials are given to each stage/step/activity in order to be used in the next activity until the final product is achieved.

We will try to describe this pizza making progress programmatically using C++ and Haskell.

Let's start with a complete C++ program

```
1  #include <iostream>
2  #include <string>
3
4  class Pastry
5  {
6  public:
7      virtual void bake_me_baby()
8      {
9          prepare_dough();
10         add_sauce();
11         add_toppings();
12         bake();
13     }
14
15     protected:
16         virtual void prepare_dough() = 0;
17         virtual void add_sauce() = 0;
18         virtual void add_toppings() = 0;
19         virtual void bake() = 0;
20 };
21
22 class Pizza : public Pastry
23 {
24     protected:
25         int time = 0;
26         std::string state = "Raw";
27
28     protected:
29         void prepare_dough()
30         {
31             if (time != 0)
32                 return;
33             time = 1;
```

```
34     state = "Prepared dough";
35 }
36 void add_sauce()
37 {
38     if (time != 1)
39         return;
40     time = 2;
41     state = "Added sauce";
42 }
43 void add_toppings()
44 {
45     if (time != 2)
46         return;
47     time = 3;
48     state = "Added toppings";
49 }
50 void bake()
51 {
52     if (time != 3)
53         return;
54     time = 4;
55     state = "Baked the hell out of this";
56 }
57
58 public:
59     void bake_me_baby()
60     {
61         prepare_dough();
62         std::cout << state << std::endl;
63         add_sauce();
64         std::cout << state << std::endl;
65         add_toppings();
66         std::cout << state << std::endl;
67         bake();
68         std::cout << state << std::endl;
69     }
70 };
71
72 int main(int argc, char **argv)
73 {
74     Pastry *pizza = new Pizza();
75     pizza->bake_me_baby();
76     delete pizza;
77     return 0;
78 }
```

Output of this program

```
1 >>> g++ -g main.cpp -o main && ./main
2 1 Prepared dough
3 2 Added sauce
```



```
4 3 Added toppings
5 4 Baked the hell out of this
```

Nice! Let's do this again, but with Haskell

```
1 module Main (main) where
2
3 data Pizza = Pizza {time :: Int, state :: String} deriving (Show)
4
5 prepareDough :: Pizza -> Pizza
6 prepareDough pizza@(Pizza t _)
7   | t /= 0 = pizza
8   | otherwise = pizza {time = 1, state = "Prepared dough"}
9
10 addSauce :: Pizza -> Pizza
11 addSauce pizza@(Pizza t _)
12   | t /= 1 = pizza
13   | otherwise = pizza {time = 2, state = "Added sauce"}
14
15 addToppings :: Pizza -> Pizza
16 addToppings pizza@(Pizza t _)
17   | t /= 2 = pizza
18   | otherwise = pizza {time = 3, state = "Added toppings"}
19
20 bake :: Pizza -> Pizza
21 bake pizza@(Pizza t _)
22   | t /= 3 = pizza
23   | otherwise = pizza {time = 4, state = "Baked the hell out of
24   this"}
25
26 bakeMeBaby :: Pizza -> IO ()
27 bakeMeBaby pizza = do
28   let pizza1 = prepareDough pizza
29   print pizza1
30   let pizza2 = addSauce pizza1
31   print pizza2
32   let pizza3 = addToppings pizza2
33   print pizza3
34   let pizza4 = bake pizza3
35   print pizza4
36
37 main :: IO ()
38 main = do
39   let pizza = Pizza 0 "Raw"
40   bakeMeBaby pizza
```

Output of this program

```
1 >>> ghc -g main.hs -o main && ./main
2 [1 of 1] Compiling Main                ( main.hs, main.o )
3 Linking main ...
```



```
4 Pizza {time = 1, state = "Prepared dough"}  
5 Pizza {time = 2, state = "Added sauce"}  
6 Pizza {time = 3, state = "Added toppings"}  
7 Pizza {time = 4, state = "Baked the hell out of this"}
```

2 Comparing the pizza-making methods

With the pizza making out of the way, there are definitely some things noticeable between the two approaches. Obviously, the procedure of the process does not change, but the way the materials or the pizza, otherwise known as the data, are handled and processed is different. Considering the context of this report, this is what I concluded

	OOP	FP
Pros		
Cons		

Easter egg