

COMP 333
Spring 2021

Generics, Parametric Polymorphism, and Higher-Order Functions in Swift

1.) Define a function that takes a value of some generic type A , and returns the same value.

```
func myFunc<A>(a: A) -> A {  
    return a;  
}
```

2.) Define a function that takes values of generic types A and B , and returns a pair of these values.

```
func myFunc<A, B>(a: A, b: B) -> (A, B) {  
    return (a, b)  
}
```

3.) Write the body of the following Swift function. As a hint, only one possible body (which typechecks) exists.

```
func myFunc<A, B, C, D>(a: A, b: B,  
                        f1: (A) -> C,  
                        f2: (A, C) -> D) -> (C, D) {  
    let c = f1(a);  
    let d = f2(a, c);  
    return (c, d);  
}
```

4.) Consider the following `enum` definition, defining the structure of a linked list:

```
indirect enum List<A> {  
  case cons(A, List<A>)  
  case empty  
}
```

4.a.) Define the `map` function, which has the following signature:

```
func map<A, B>(list: List<A>, f: (A) -> B) -> List<B> {  
  switch list {  
    case .empty:  
      return List.empty;  
    case .cons(let head, let tail):  
      return List.cons(f(head), map(list: tail, f: f))  
  }  
}
```

4.b.) Define the `foldLeft` function, which has the following signature:

```
func foldLeft<A, B>(list: List<A>,  
  accum: B,  
  f: (B, A) -> B) -> B {  
  switch list {  
    case .empty:  
      return accum;  
    case .cons(let head, let tail):  
      return foldLeft(list: tail,  
        accum: f(accum, head),  
        f: f)  
  }  
}
```