INFSEN02-1 Exam

Regular exam

1 Question 1

Given the following lambda program, and a series of relevant delta rules, complete the empty beta reduction steps for this program.

```
if FALSE then A else B
```

1.1 Relevant delta rules

If-then-else

```
(λp th el→((p th) el))
```

False

```
(λt f→f)
```

1.2 Answer 1

```
if FALSE then A else B
```

```
(((if-then-else FALSE) A) B)
```

```
(((λp th el→((p th) el)) FALSE) A) B)
```

```
((((λp th el→((p th) el)) FALSE) A) B)
```

```
((((λp th el→((p th) el)) (λt f→f)) A) B)
```

```
(((λp th el→((p th) el)) (λt f→f)) A) B)
```

```
(((λth el→((λt f→f) th) el)) A) B)
```

```
( ((λth el→(((λt f→f) th) el)) A) B)
```

```
((λel→(((λt f→f) A) el)) B)
```

```
((λel→(((λt f→f) A) el)) B)
```

```
(((λt f→f) A) B)
```

```
( ((λt f→f) A) B)
```

```
((λf→f) B)
```

```
((λf→f) B)
```

```
B
```

2 Question 2

Given the following lambda calculus program complete typing derivation for the program.

```
(λ(f:(Nat→String)) (x:Nat)→(f x))
```

2.1 Answer 2

```
(λ(f:(Nat→String)) (x:Nat)→(f x))
```

```
(λ(f:(Nat→String)) (x:Nat)→(f x))
```

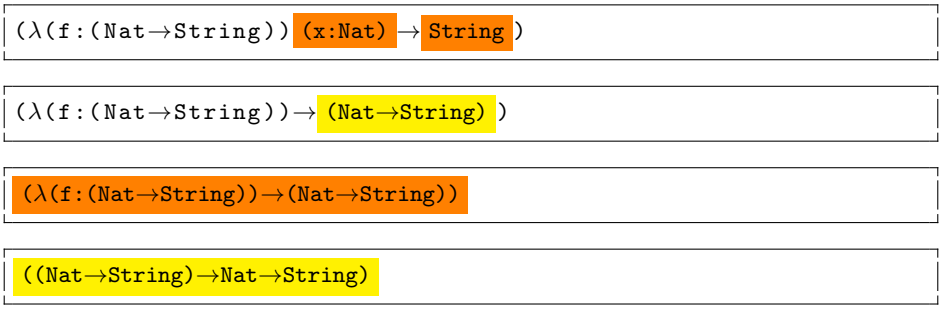
```
(λ(f:(Nat→String)) (x:Nat)→( (Nat→String) x))
```

```
(λ(f:(Nat→String)) (x:Nat) → ((Nat→String) x) )
```

```
(λ(f:(Nat→String)) (x:Nat)→((Nat→String) Nat))
```

```
(λ(f:(Nat→String)) (x:Nat)→ ((Nat→String) Nat) )
```

```
(λ(f:(Nat→String)) (x:Nat)→ String )
```


(λ(f:(Nat→String)) (x:Nat) → String)
(λ(f:(Nat→String))→ (Nat→String))
(λ(f:(Nat→String))→(Nat→String))
((Nat→String)→Nat→String)