

CS320 Programming Languages

Exercise #1

1 Free Identifiers

Implement the function **freeIds**, which takes a **WAE** and produces a set of strings. The set should contain a string for each free identifier in the given **WAE**.

```
def freeIds(expr: WAE): Set[String] = ???

test(freeIds(WAE("{with {x 1} {+ x y}}")), Set("y"))
test(freeIds(WAE("{with {z 2} 1}")), Set())
```

2 Binding Identifiers

Implement the function **bindingIds**, which is like **freeIds**, but the result set contains a string for each binding identifier in the given **WAE** (whether or not the binding identifier is ever referenced by a bound identifier).

```
def bindingIds(expr: WAE): Set[String] = ???

test(bindingIds(WAE("{with {x 1} {+ x y}}")), Set("x"))
test(bindingIds(WAE("{with {z 2} 1}")), Set("z"))
```

3 Bound Identifiers

Implement the function **boundIds**, which is like **freeIds**, but the result set contains a string for each bound identifier in the given **WAE**.

```
def boundIds(expr: WAE): Set[String] = ???

test(boundIds(WAE("{with {x 1} {+ x y}}")), Set("x"))
test(boundIds(WAE("{with {z 2} 1}")), Set())
```