CS 360
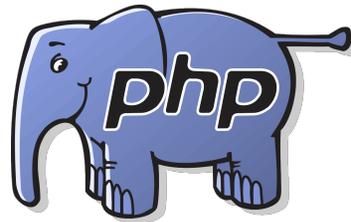# Programming Languages
Day 12 – Lexical Scope II

Closures

A ***closure*** is a data structure used to implement first-class functions.

- A closure has two parts:
  - The code
  - The environment that was current when the function was ***defined.***

- **Key idea of lexical scoping**:
  When a function **f** is called, **f**'s code is evaluated in the environment that was stored alongside that code when the closure was created.
  - (The environment is first extended with extra bindings for the values of **f**'s arguments.)

Comparison of C++ and Racket

```
(define x 5)
(define (add1 x) (+ x 1))
(define y (add1 7))
```

```cpp
int add1(int x) {
   return x + 1;
}

int main() {
   int x = 5;
   int y = add1(x);
   return 0;
}
```

```
(define (make-adder y)
  (lambda (x) (+ x y)))

(define add3 (make-adder 3))
(define add4 (make-adder 4))

(define z (add3 10))
(define w (add4 20))
```