

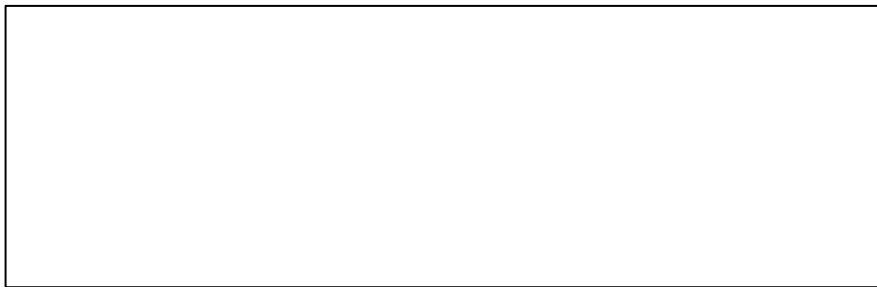
Discussion Section 6

October 16th and 18th, 2019

Questions?

Midterm 1 Review

What's the Output?



```
function app(f, x) {  
    return f(x);  
}  
  
app(function(z) {  
    console.log('1');  
    return function(w) {  
        console.log('2');  
    };  
}, function(y) {  
    console.log('3');  
});
```

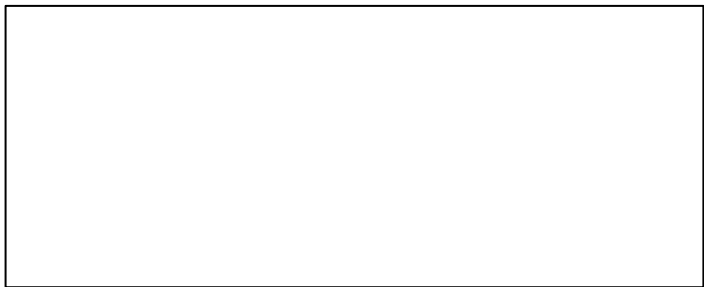
What's the Output?

1

```
function app(f, x) {  
    return f(x);  
}  
  
app(function(z) {  
    console.log('1');  
    return function(w) {  
        console.log('2');  
    };  
}, function(y) {  
    console.log('3');  
});
```

What's the Output?

```
let arr = [ ];
let o = { x: 1 };
for (let i = 0; i < 10; i = i + 1) {
  arr.push(o);
}
arr[3].x = 100;
let sum = 0;
for (let i = 0; i < 10; i = i + 1) {
  sum = sum + arr[i].x;
}
console.log(sum);
```



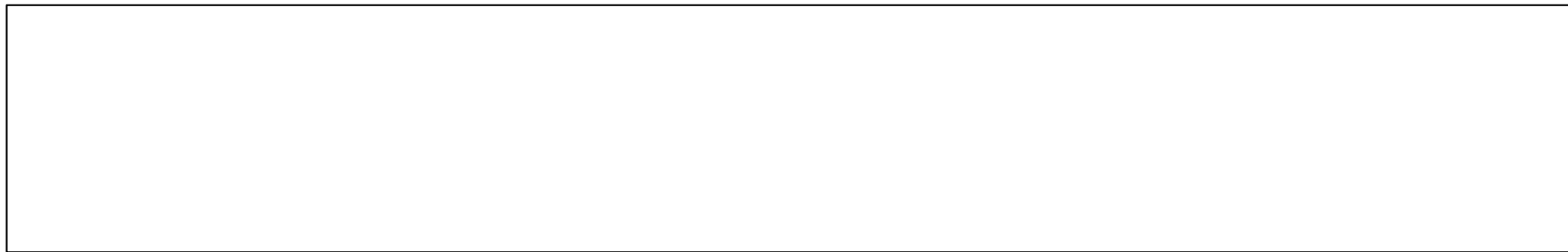
What's the Output?

```
let arr = [ ];
let o = { x: 1 };
for (let i = 0; i < 10; i = i + 1) {
  arr.push(o);
}
arr[3].x = 100;
let sum = 0;
for (let i = 0; i < 10; i = i + 1) {
  sum = sum + arr[i].x;
}
console.log(sum);
```

1000

What's the Output?

```
let X = { a: 10, b: { a: 100 } };  
X.b = X;  
X.b.a = 200;  
console.log(X.a);
```

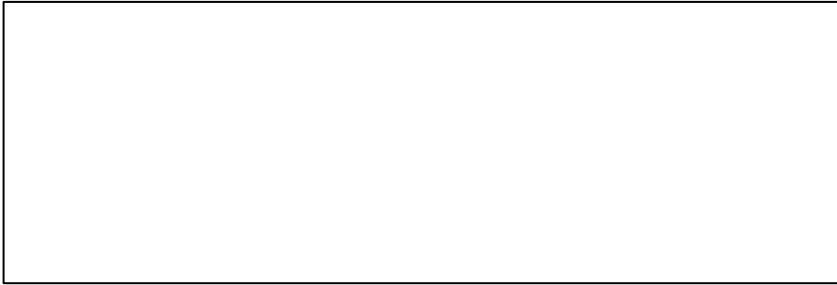


What's the Output?

```
let X = { a: 10, b: { a: 100 } };  
X.b = X;  
X.b.a = 200;  
console.log(X.a);
```

200

Value for x and y so D(x, y) displays: AB



```
function D(x, y) {  
  if (x < y) {  
    console.log('A');  
  }  
  function C() {  
    if (x > 10) {  
      console.log('B');  
    }  
  }  
  if (x + y > 10) {  
    C();  
  }  
}
```

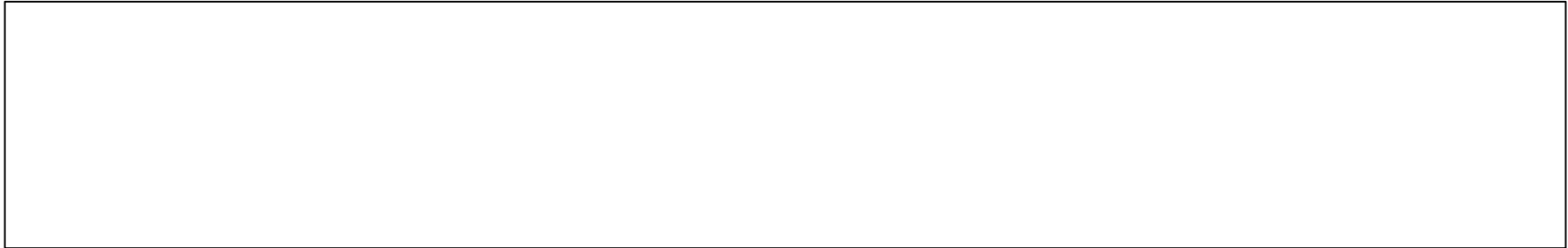
Value for x and y so D(x, y) displays: AB

`x < y && x+y > 10 && x > 10`

```
function D(x, y) {  
  if (x < y) {  
    console.log('A');  
  }  
  function C() {  
    if (x > 10) {  
      console.log('B');  
    }  
  }  
  if (x + y > 10) {  
    C();  
  }  
}
```

Value for f so K(f) displays: 220

```
function K(f) {  
  f(function(x) {  
    return function() {  
      console.log(x);  
    }  
  });  
}
```



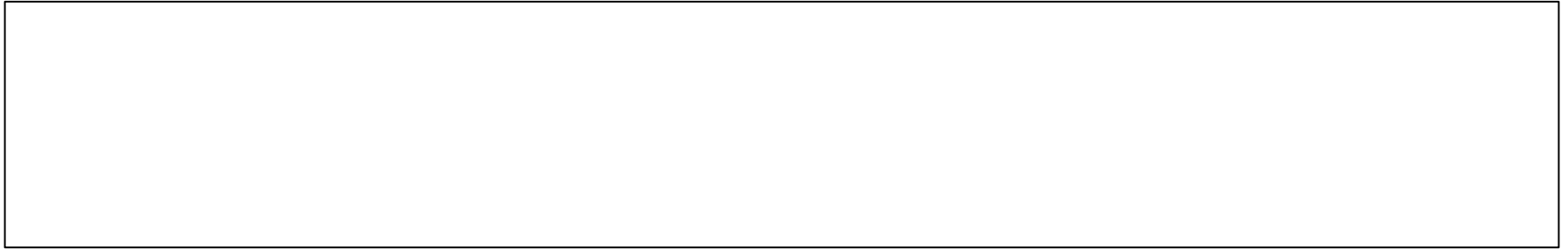
Value for f so K(f) displays: 220

```
function K(f) {  
  f(function(x) {  
    return function() {  
      console.log(x);  
    }  
  });  
}
```

```
function f(g) {  
  let h = g(220);  
  h();  
}
```

Value for f so T(f) displays: 220

```
function T(f) {  
    f(function(x) { console.log(x); });  
}
```



Value for f so T(f) displays: 220

```
function T(f) {  
    f(function(x) { console.log(x); });  
}
```

```
function T(f) {  
    f(function(x) { console.log(x); });  
}
```

Value for f so J(f) displays: A

```
function J(f) {  
  f(function(x) {  
    if (x < 5) { console.log("A"); }  
  },  
  function(y, z) {  
    if (y < z) { return function() { console.log("B"); }; };  
    else { return function() { console.log("C"); } }  
  });  
}
```

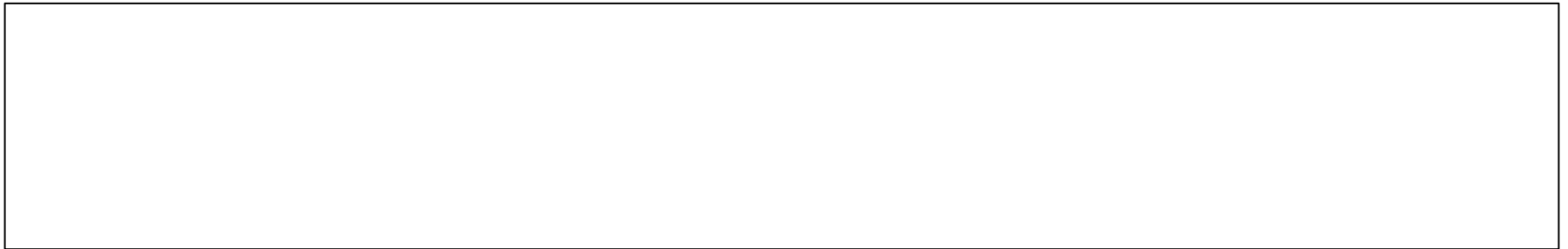

Value for f so J(f) displays: A

```
function J(f) {  
  f(function(x) {  
    if (x < 5) { console.log("A"); }  
  },  
  function(y, z) {  
    if (y < z) { return function() { console.log("B"); }; }  
    else { return function() { console.log("C"); } }  
  });  
}
```

```
function f(g, h) {  
  g(1)  
}
```

Value for f so J(f) displays: B

```
function J(f) {  
  f(function(x) {  
    if (x < 5) { console.log("A"); }  
  },  
  function(y, z) {  
    if (y < z) { return function() { console.log("B"); }; };  
    else { return function() { console.log("C"); } }  
  });  
}
```



Value for f so J(f) displays: B

```
function J(f) {  
  f(function(x) {  
    if (x < 5) { console.log("A"); }  
  },  
  function(y, z) {  
    if (y < z) { return function() { console.log("B"); }; }  
    else { return function() { console.log("C"); } }  
  });  
}
```

```
function f(g, h) {  
  h(1, 2());  
}
```

Value for f so J(f) displays: CB

```
function J(f) {  
  f(function(x) {  
    if (x < 5) { console.log("A"); }  
  },  
  function(y, z) {  
    if (y < z) { return function() { console.log("B"); }; };  
    else { return function() { console.log("C"); } }  
  });  
}
```

Value for f so J(f) displays: CB

```
function J(f) {  
  f(function(x) {  
    if (x < 5) { console.log("A"); }  
  },  
  function(y, z) {  
    if (y < z) { return function() { console.log("B"); }; }  
    else { return function() { console.log("C"); } }  
  });  
}
```

```
function f(g, h) {  
  h(2, 1());  
  h(1, 2());  
}
```

Implement map using map2

```
// map2<A,B,C>(f: (x: A, y: B) => C, arr1: A[], arr2: B[]): C[]  
// Assumes that arr1.length === arr2.length  
function map2(f, arr1, arr2) {  
  let r = [ ];  
  for (let i = 0; i < arr1.length; i = i + 1) {  
    r.push(f(arr1[i], arr2[i]));  
  }  
  return r;  
}
```

Implement map using map2

```
// map2<A,B,C>(f: (x: A, y: B) => C, arr1: A[], arr2: B[]): C[]  
// Assumes that arr1.length === arr2.length  
function map2(f, arr1, arr2) {  
  let r = [ ];  
  for (let i = 0; i < arr1.length; i = i + 1) {  
    r.push(f(arr1[i], arr2[i]));  
  }  
  return r;  
}
```

```
function map(f, arr) {  
  function g(x, y) { return f(x); }  
  return map2(g, arr, arr);  
}
```

Implement map2 using zip

```
// zip:(arr1: A[], arr2: B[]): { first: A, second: B}[]  
function zip(arr1, arr2) {  
  let r = [ ];  
  for (let i = 0; i < arr1.length; i = i + 1) {  
    r.push({ first: arr1[i], second: arr2[i] });  
  }  
  return r;  
}
```



Implement map2 using zip

```
// zip: (arr1: A[], arr2: B[]): { first: A, second: B }[]  
function zip(arr1, arr2) {  
  let r = [ ];  
  for (let i = 0; i < arr1.length; i = i + 1) {  
    r.push({ first: arr1[i], second: arr2[i] });  
  }  
  return r;  
}
```

```
function map2(f, arr1, arr2) {  
  let pairs = zip(arr1, arr2);  
  function g(p) { return f(p.first, p.second); }  
  return pairs.map(g);  
}
```

Implement filterMap, traverse ONCE

```
// filterMap<A,B>(f: (x: A) => B, g: (y: B) => boolean, arr: A[]): B[]  
function filterMap(f, g, arr) {  
    return filter(g, map(f, arr));  
}
```



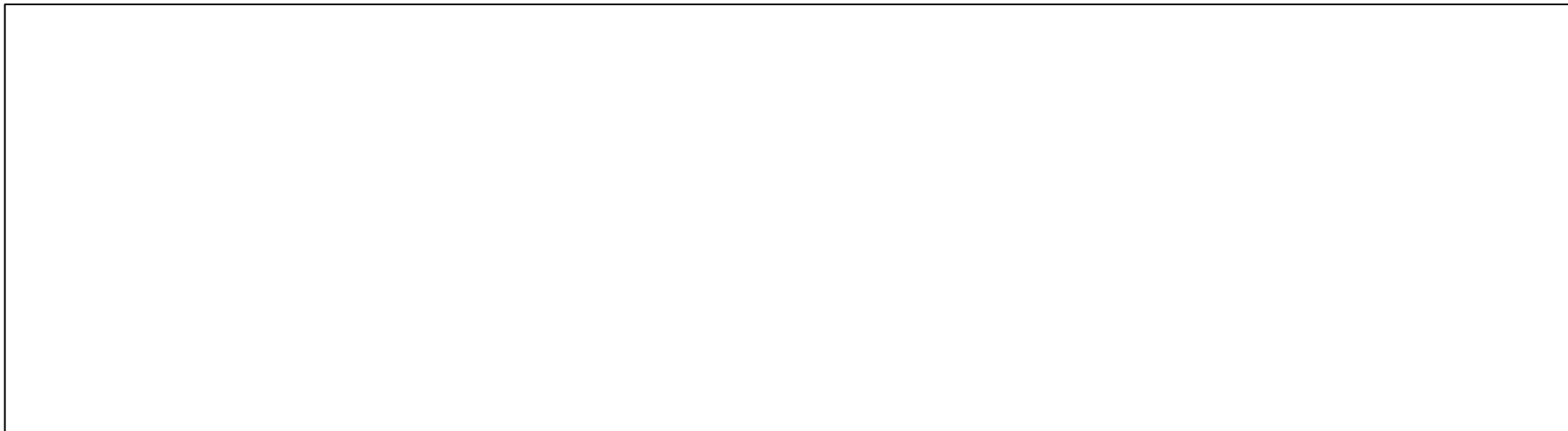
Implement filterMap, traverse ONCE

```
// filterMap<A,B>(f: (x: A) => B, g: (y: B) => boolean, arr: A[]): B[]  
function filterMap(f, g, arr) {  
    return filter(g, map(f, arr));  
}
```

```
function filterMap(f,g,arr) {  
    let r = [];  
    for (let i = 0; i < arr.length; i = i + 1) { let tmp = f(arr[i]);  
        if (g(tmp)) {  
            r.push(tmp); }  
        }  
    return r;  
}
```

Make 1 version error, the other not error

```
// filterMap<A,B>(f: (x: A) => B, g: (y: B) => boolean, arr: A[]): B[]  
function filterMap(f, g, arr) {  
    return filter(g, map(f, arr));  
}
```



Make 1 version error, the other not error

```
// filterMap<A,B>(f: (x: A) => B, g: (y: B) => boolean, arr: A[]): B[]  
function filterMap(f, g, arr) {  
    return filter(g, map(f, arr));  
}
```

```
let count = 0;  
let arr = [1,2,3];  
function f(x) {  
    count = count + 1;  
    return x;  
}  
function g(x) {  
    if (count < 3) { throw 'error'; } return true;  
}
```

Implement doubleFilter, traverse ONCE

```
// doubleFilter<A>(f1: (x: A) => bool, f2: (x: A) => bool, arr: A[]): A[]  
function doubleFilter(f1, f2, arr) {  
    return arr.filter(f1).filter(f2);  
}
```



Implement doubleFilter, traverse ONCE

```
// doubleFilter<A>(f1: (x: A) => bool, f2: (x: A) => bool, arr: A[]): A[]  
function doubleFilter(f1, f2, arr) {  
    return arr.filter(f1).filter(f2);  
}
```

```
function doubleFilter(f1, f2, arr) {  
    return arr.filter(function(x) { return f1(x) && f2(x); });  
}
```

Implement doubleFilter, USE REDUCE

```
// doubleFilter<A>(f1: (x: A) => bool, f2: (x: A) => bool, arr: A[]): A[]  
function doubleFilter(f1, f2, arr) {  
    return arr.filter(f1).filter(f2);  
}
```



Implement doubleFilter, USE REDUCE

```
// doubleFilter<A>(f1: (x: A) => bool, f2: (x: A) => bool, arr: A[]): A[]  
function doubleFilter(f1, f2, arr) {  
    return arr.filter(f1).filter(f2);  
}
```

```
function doubleFilter(f1, f2, arr) {  
    return arr.reduce(function (x, acc) {  
        if (f1(x) && f2(x)) {  
            acc.push(x);  
        }  
        return acc;  
    }, []);  
}
```

Review: Stable Marriage Problem

A marriage is NOT stable if given to matches *Match1* and *Match2*,

1. There is an element in *A* in the set *Match1* which prefers some given element *B* from *Match2* over the element to which *A* is already matched

AND

2. The element *B* in *Match2* also prefers *A* over the element to which *B* is already matched

Are these Matches stable, why or why not?

```
candidates = [  
  [0, 1, 2],  
  [1, 2, 0],  
  [2, 1, 0],  
];  
  
companies = [  
  [0, 2, 1],  
  [2, 1, 0],  
  [1, 2, 0],  
];
```

```
[  
  {  
    company: 0 ,  
    candidate: 1  
  },  
  {  
    company: 1 ,  
    candidate: 2  
  },  
  {  
    company: 2 ,  
    Candidate: 0  
  }  
]
```

Is the provided answer stable?

Companies' Preferences

C0	K0	K1
C1	K0	K1

Candidates' Preferences

K0	C1	C0
K1	C1	C0

C0	K0
C1	K1

Is the provided answer stable?

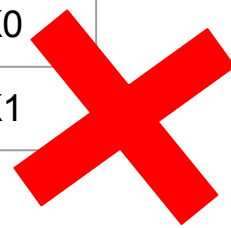
Companies' Preferences

C0	K0	K1
C1	K0	K1

Candidates' Preferences

K0	C1	C0
K1	C1	C0

C0	K0
C1	K1



Is the provided answer stable?

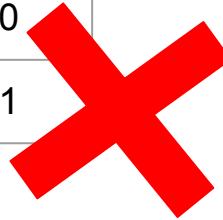
Companies' Preferences

C0	K0	K1
C1	K0	K1

Candidates' Preferences

K0	C1	C0
K1	C1	C0

C0	K0
C1	K1



C1 and K0 would rather be with each other!

Is the provided answer correct?

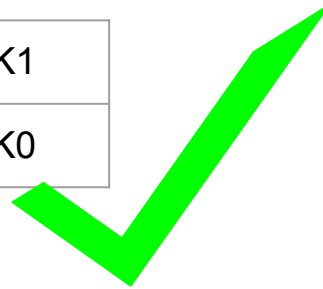
Companies' Preferences

C0	K0	K1
C1	K0	K1

Candidates' Preferences

K0	C1	C0
K1	C1	C0

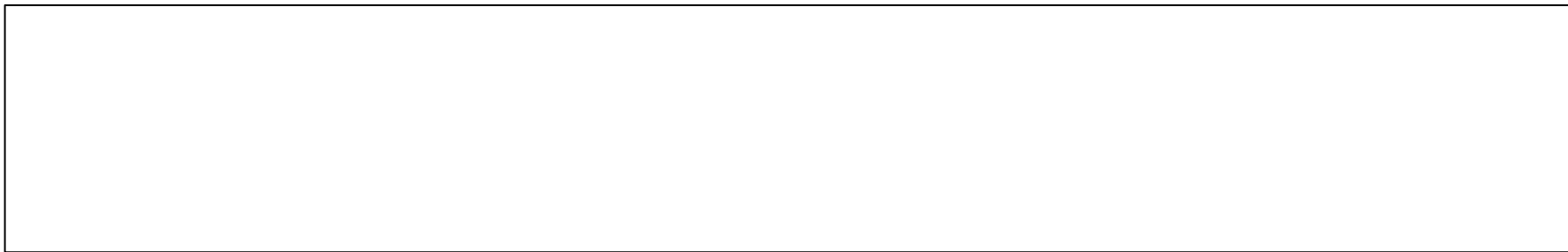
C0	K1
C1	K0



Additional Midterm 1 Review

What's the Output?

```
function F1(x) {  
  if (x === 3) {  
    return;  
  }  
  console.log(x);  
  F1(x + 1);  
}  
F1(1);
```

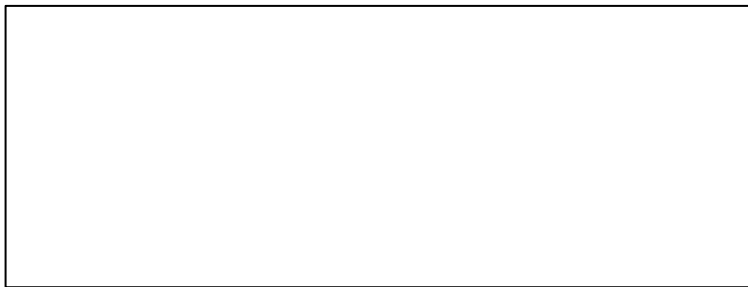


What's the Output?

```
function F1(x) {  
  if (x === 3) {  
    return;  
  }  
  console.log(x);  
  F1(x + 1);  
}  
F1(1);
```

1
2

What's the Output?



```
function mystery(f, n) {
  if (n === 0) {
    return function(x) { return x; }
  } else {
    return function(x) {
      return mystery(f, n - 1)(f(x, n));
    }
  }
}

function H(x, n) {
  return x + n.toString();
}

console.log(mystery(H, 5)(''))
```

What's the Output?

54321

```
function mystery(f, n) {
  if (n === 0) {
    return function(x) { return x; }
  } else {
    return function(x) {
      return mystery(f, n - 1)(f(x, n));
    }
  }
}

function H(x, n) {
  return x + n.toString();
}

console.log(mystery(H, 5)(''))
```

What's the Output?

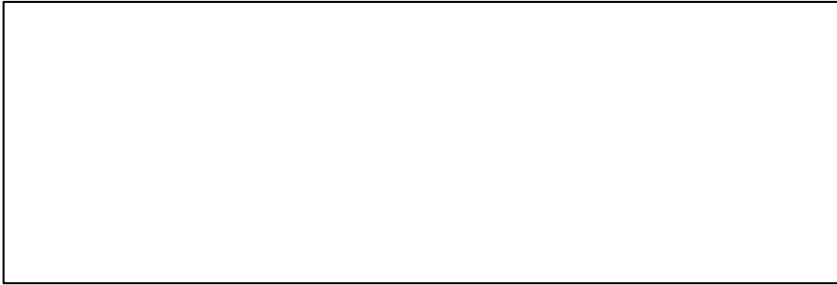
```
let X = { a: 10, b: { a: 100 } };  
X.b.a = X;  
console.log(X.b.a.a);
```

What's the Output?

```
let X = { a: 10, b: { a: 100 } };  
X.b.a = X;  
console.log(X.b.a.a);
```

10

Value for x and y so D(x, y) displays: A



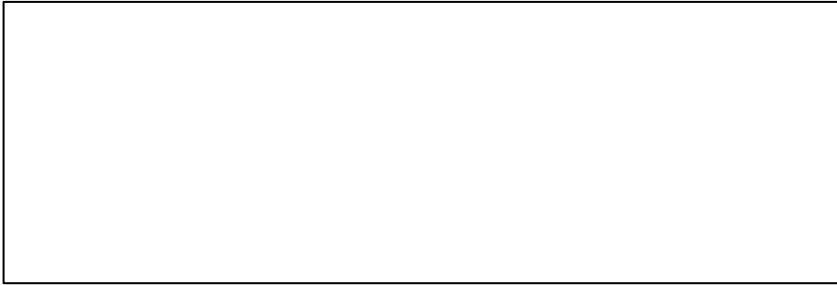
```
function D(x, y) {  
  if (x < y) {  
    console.log('A');  
  }  
  function C() {  
    if (x > 10) {  
      console.log('B');  
    }  
  }  
  if (x + y > 10) {  
    C();  
  }  
}
```

Value for x and y so D(x, y) displays: A

`x < y && (x + y) <= 10`

```
function D(x, y) {  
  if (x < y) {  
    console.log('A');  
  }  
  function C() {  
    if (x > 10) {  
      console.log('B');  
    }  
  }  
  if (x + y > 10) {  
    C();  
  }  
}
```

Value for x and y so D(x, y) displays: B



```
function D(x, y) {  
  if (x < y) {  
    console.log('A');  
  }  
  function C() {  
    if (x > 10) {  
      console.log('B');  
    }  
  }  
  if (x + y > 10) {  
    C();  
  }  
}
```


Value for x and y so D(x, y) displays: B

`x > y && x+y > 10 && x > 10`

```
function D(x, y) {  
  if (x < y) {  
    console.log('A');  
  }  
  function C() {  
    if (x > 10) {  
      console.log('B');  
    }  
  }  
  if (x + y > 10) {  
    C();  
  }  
}
```