

CS 100J Review Session

Executing Method Calls

What is in a Frame?

- Method name
- Instruction counter
- Scope box
 - Instance name for non-static method
 - Class name for static method
- Parameters
- All local variables

Frame Example

```
public class Math {
    public static int sumOfSqs(int x, int y){
        int x2= x*x;
        int y2= y*y;
        int s= x2+y2;
        return s;
    }
}
```

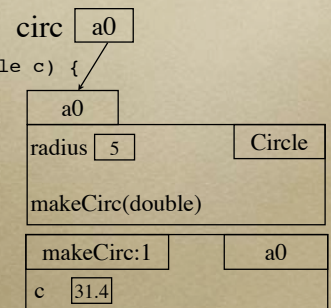
```
Math.sumOfSqs(3,4);
```

sumOfSqs:4	Math
x	3
y	4
x2	9
y2	16
s	25

Frame Example

```
public class Circle {
    private double radius;
    public void makeCirc(double c) {
        radius= c/(2*3.14);
    }
}
```

```
Circle circ= new Circle(3);
circ.makeCirc(31.4);
```



Using Frames for Loops

- Write code for invariant
- Create short example
- Begin code execution
- Check invariant immediately before loop
- Execute body of loop once
- Check invariant
- Continue to make sure invariant is true and loop terminates

Frame Invariant Example

Find the minimum value in an array
Precondition: $h \leq k$
Postcondition: $b[x]$ is the minimum of $b[h..k]$
invariant: $b[x]$ is the minimum of $b[h..t]$

```
public static int min(int[] b,h,k) {
    t= h;
    x= t-1;
    while(t != k+1) {
        if(b[t] < b[x]) x= t+1;
        t= t+1;
    }
    return x;
}
```

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t-1;
    while(t != k+1) {
        if(b[t] < b[x]) x= t+1;
        t= t+1;
    }
    return x;
}
```

```
int[] a= {2,1,3};
Array.min(a,0,2);
```

	min:1	Array
b	[2,1,3]	
h	0	
k	2	
t		
x		

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t-1;
    while(t != k+1) {
        if(b[t] < b[x]) x= t+1;
        t= t+1;
    }
    return x;
}
```

```
int[] a= {2,1,3};
Array.min(a,0,2);
```

	min:2	Array
b	[2,1,3]	
h	0	
k	2	
t	0	
x		

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t-1;
    while(t != k+1) {
        if(b[t] < b[x]) x= t+1;
        t= t+1;
    }
    return x;
}
```

```
int[] a= {2,1,3};
Array.min(a,0,2);
```

	min:3	Array
b	[2,1,3]	
h	0	
k	2	
t	0	
x	-1	

Frame Invariant Example

	min:3	Array
b	[2,1,3]	
h	0	
k	2	
t	0	
x	-1	

NO!

b[-1] is the minimum of b[0..0]?

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t;
    while(t != k+1) {
        if(b[t] < b[x]) x= t+1;
        t= t+1;
    }
    return x;
}
```

```
int[] a= {2,1,3};
Array.min(a,0,2);
```

	min:3	Array
b	[2,1,3]	
h	0	
k	2	
t	0	
x	0	

Frame Invariant Example

	min:3	Array
b	[2,1,3]	
h	0	
k	2	
t	0	
x	0	

b[0] is the minimum of b[0..0]?

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t;
    while(t != k+1) {
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        t= t+1;
    }
    return x;
}
```

```
int[] a= {2,1,3};
Array.min(a,0,2);
```

min:4		Array
b	[2,1,3]	
h	0	
k	2	
t	0	
x	0	

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t;
    while(t != k+1) {
        if(b[t] < b[x]) x= t+1;
        t= t+1;
    }
    return x;
}
```

```
int[] a= {2,1,3};
Array.min(a,0,2);
```

min:5		Array
b	[2,1,3]	
h	0	
k	2	
t	0	
x	0	

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t;
    while(t != k+1) {
        if(b[t] < b[x]) x= t+1;
        t= t+1;
    }
    return x;
}
```

```
int[] a= {2,1,3};
Array.min(a,0,2);
```

min:3		Array
b	[2,1,3]	
h	0	
k	2	
t	1	
x	0	

Frame Invariant Example

min:3		Array
b	[2,1,3]	
h	0	
k	2	
t	1	
x	0	

b[0] is the minimum of b[0..1]?

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t;
    while(t != k+1) {
        if(b[t+1] < b[x]) x= t+1;
        t= t+1;
    }
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}
```

```
int[] a= {2,1,3};
Array.min(a,0,2);
```

min:5		Array
b	[2,1,3]	
h	0	
k	2	
t	1	
x	1	

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
    x= t;
    while(t != k+1) {
        if(b[t+1] < b[x]) x= t+1;
        t= t+1;
    }
    return x;
}
```

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int[] a= {2,1,3};
Array.min(a,0,2);
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min:3		Array
b	[2,1,3]	
h	0	
k	2	
t	1	
x	1	

Frame Invariant Example

min:3	Array
b	[2,1,3]
h	0
k	2
t	2
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b[1] is the minimum of b[0..1]?

Frame Invariant Example

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public static int min(int[] b,h,k) {
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    while(t != k+1) {
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        t= t+1;
    }
    return x;
}
```

min:4	Array
b	[2,1,3]
h	0
k	2
t	1
x	1

```
int[] a= {2,1,3};
Array.min(a,0,2);
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Frame Invariant Example

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min:3	Array
b	[2,1,3]
h	0
k	2
t	2
x	1

Frame Invariant Example

min:3	Array
b	[2,1,3]
h	0
k	2
t	2
x	1

b[1] is the minimum of b[0..2]?

Frame Invariant Example

```
public static int min(int[] b,h,k) {
    t= h;
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```

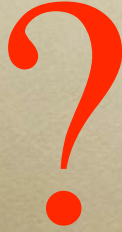
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