INFDEV02-2
Homework 4

The DEV Team

Abstraction, functions, recursion, lambdas, and data structures.

Contents

1 Lecture Homework 4 - Drawing with lambdas

1.1 Homework 4 - Grid

Fill in the missing code blocks.

```
1   def draw_grid (x_dim,y_dim,p):
2     res=""
3     x=0
4     y=0
5     while((y<y_dim)):
6       while((x<x_dim)):
7         if(            (x,y)):
8                     =(res+        )
9         else:
10                    =(res+         )
11        x=(x+1)
12      res=(res+"\n")
13               =0
14               =(         +         )
15    return res
16  print (draw_grid(3,3,lambda  x,y:           ))
```

```
                globals
                stack
                heap
                definitions   draw_grid  (x_dim,y_dim,p) => ...
                output              "###\n###\n###\n"
                globals
                stack
                heap
                definitions   draw_grid  (x_dim,y_dim,p) => ...
                globals
                                    ret      "###\n###\n###\n"
                                    x_dim          3
                                    y_dim          3
                stack               p          lambda -> @3
                                    res      "###\n###\n###\n"
                                    x              0
                                    y              3
                heap
                definitions   draw_grid  (x_dim,y_dim,p) => ...
```

```
globals
                        ret          null
                        x_dim         3
                        y_dim         3
        stack           p          lambda -> @3
                        res     "###\n###\n###\n"
                        x             0
                        y             3
        heap
        definitions   draw_grid   (x_dim,y_dim,p) => ...
globals
                        ret          null
                        x_dim         3
                        y_dim         3
        stack           p          lambda -> @3
                        res     "###\n###\n###\n"
                        x             0
                        y             3
        heap
        definitions   draw_grid   (x_dim,y_dim,p) => ...
globals
                        ret          null
                        x_dim         3
                        y_dim         3
        stack           p          lambda -> @3
                        res     "###\n###\n###\n"
                        x             0
                        y             2
        heap
        definitions   draw_grid   (x_dim,y_dim,p) => ...
globals
                        ret          null
                        x_dim         3
                        y_dim         3
        stack           p          lambda -> @3
                        res     "###\n###\n###\n"
                        x             3
                        y             2
        heap
        definitions   draw_grid   (x_dim,y_dim,p) => ...
```

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n###"
	x	3
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n###"
	x	3
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n###"
	x	2
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n##"
	x	2
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
stack	p	lambda -> @3	
	res	"###\n###\n##"	
	x	2	
	y	2	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n###\n##"	
stack	x	2	
	y	2	
		ret	True
		x	2
		y	2
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n###\n##"	
stack	x	2	
	y	2	
		ret	null
		x	2
		y	2
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n##"
	x	2
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n##"
	x	2
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n##"
	x	1
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n#"
	x	1
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
stack	p	lambda -> @3	
	res	"###\n###\n#"	
	x	1	
	y	2	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n###\n#"	
stack	x	1	
	y	2	
		ret	True
		x	1
		y	2
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n###\n#"	
stack	x	1	
	y	2	
		ret	null
		x	1
		y	2
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

```
globals
                    _____
                    ret          null
                    x_dim         3
                    y_dim         3
stack               p          lambda -> @3
                    res      "###\n###\n#"
                    x             1
                    y             2
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
globals
                    _____
                    ret          null
                    x_dim         3
                    y_dim         3
stack               p          lambda -> @3
                    res      "###\n###\n#"
                    x             1
                    y             2
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
globals
                    _____
                    ret          null
                    x_dim         3
                    y_dim         3
stack               p          lambda -> @3
                    res      "###\n###\n#"
                    x             0
                    y             2
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
globals
                    _____
                    ret          null
                    x_dim         3
                    y_dim         3
stack               p          lambda -> @3
                    res      "###\n###\n"
                    x             0
                    y             2
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
stack	p	lambda -> @3	
	res	"###\n###\n"	
	x	0	
	y	2	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n###\n"	
stack	x	0	
	y	2	
		ret	True
		x	0
		y	2
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n###\n"	
stack	x	0	
	y	2	
		ret	null
		x	0
		y	2
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n"
	x	0
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n"
	x	0
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n"
	x	0
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n"
	x	0
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###\n"
	x	3
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###"
	x	3
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###"
	x	3
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n###"
	x	2
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals			
stack	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n##"	
	x	2	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
stack	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n##"	
	x	2	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
stack	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n##"	
	x	2	
	y	1	
		ret	True
		x	2
		y	1
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

```
globals
                  ────────────────────────────
                  ret          null
                  x_dim         3
                  y_dim         3
                  p       lambda -> @3
                  res      "###\n##"
stack
                  x             2
                  y             1
                  ════════════════════════════
                       ret   null
                       x      2
                       y      1
                  ────────────────────────────
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```
```
globals
                  ────────────────────────────
                  ret          null
                  x_dim         3
                  y_dim         3
stack             p       lambda -> @3
                  res      "###\n##"
                  x             2
                  y             1
                  ────────────────────────────
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```
```
globals
                  ────────────────────────────
                  ret          null
                  x_dim         3
                  y_dim         3
stack             p       lambda -> @3
                  res      "###\n##"
                  x             2
                  y             1
                  ────────────────────────────
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```
```
globals
                  ────────────────────────────
                  ret          null
                  x_dim         3
                  y_dim         3
stack             p       lambda -> @3
                  res      "###\n##"
                  x             1
                  y             1
                  ────────────────────────────
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n#"
	x	1
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n#"
	x	1
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"###\n#"	
	x	1	
	y	1	
stack		ret	True
		x	1
		y	1
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals		
	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	"###\n#"
stack	x	1
	y	1
	ret	null
	x	1
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n#"
	x	1
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n#"
	x	1
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n#"
	x	0
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n"
	x	0
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###\n"
	x	0
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	"###\n"
stack	x	0
	y	1
	ret	True
	x	0
	y	1
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

```
globals
              ret          null
              x_dim          3
              y_dim          3
              p        lambda -> @3
stack         res        "###\n"
              x            0
              y            1

                    ret   null
                    x      0
                    y      1

heap
definitions   draw_grid  (x_dim,y_dim,p) => ...

globals
              ret          null
              x_dim          3
              y_dim          3
stack         p        lambda -> @3
              res        "###\n"
              x            0
              y            1

heap
definitions   draw_grid  (x_dim,y_dim,p) => ...

globals
              ret          null
              x_dim          3
              y_dim          3
stack         p        lambda -> @3
              res        "###\n"
              x            0
              y            1

heap
definitions   draw_grid  (x_dim,y_dim,p) => ...

globals
              ret          null
              x_dim          3
              y_dim          3
stack         p        lambda -> @3
              res        "###\n"
              x            0
              y            1

heap
definitions   draw_grid  (x_dim,y_dim,p) => ...
```

```
globals
                           _____
                           ret          null
                           x_dim         3
                           y_dim         3
stack                      p        lambda -> @3
                           res        "###\n"
                           x            0
                           y            0
                           _____
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```

```
globals
                           _____
                           ret          null
                           x_dim         3
                           y_dim         3
stack                      p        lambda -> @3
                           res        "###\n"
                           x            3
                           y            0
                           _____
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```

```
globals
                           _____
                           ret          null
                           x_dim         3
                           y_dim         3
stack                      p        lambda -> @3
                           res         "###"
                           x            3
                           y            0
                           _____
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```

```
globals
                           _____
                           ret          null
                           x_dim         3
                           y_dim         3
stack                      p        lambda -> @3
                           res         "###"
                           x            3
                           y            0
                           _____
heap
definitions    draw_grid  (x_dim,y_dim,p) => ...
```

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"###"
	x	2
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"##"
	x	2
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"##"
	x	2
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	"##"
stack	x	2
	y	0
	ret	True
	x	2
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	"##"
stack	x	2
	y	0
	ret	null
	x	2
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"##"
	x	2
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"##"
	x	2
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"##"
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"#"
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"#"
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	"#"	
stack	x	1	
	y	0	
		ret	True
		x	1
		y	0
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals		
	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	"#"
stack	x	1
	y	0
	ret	null
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"#"
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"#"
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	"#"
	x	0
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
stack	p	lambda -> @3	
	res	""	
	x	0	
	y	0	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
stack	p	lambda -> @3	
	res	""	
	x	0	
	y	0	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals			
	ret	null	
	x_dim	3	
	y_dim	3	
	p	lambda -> @3	
	res	""	
stack	x	0	
	y	0	
		ret	True
		x	0
		y	0
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals		
stack	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	""
	x	0
	y	0

	ret	null
	x	0
	y	0

heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
stack	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	""
	x	0
	y	0

heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
stack	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	""
	x	0
	y	0

heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
stack	ret	null
	x_dim	3
	y_dim	3
	p	lambda -> @3
	res	""
	x	0
	y	0

heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	""
	x	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
	y_dim	3
stack	p	lambda -> @3
	res	""
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
	ret	null
	x_dim	3
stack	y_dim	3
	p	lambda -> @3
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
stack		
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals		
stack		
heap		
definitions		

2 Lecture Homework 4 - High order predicate combinators

2.1 Or

Fill in the missing code blocks.

```
1  up=lambda   x,y:(y==0)
2  left=lambda   x,y:(x==0)
3  OR=lambda           ,          :
4        lambda           ,         :
5            (           (         ,          ) or          (         ,        ))
6
7
8  top_or_left=          (         ,         )
9
10 a=top_or_left(0,0)
11 b=top_or_left(0,1)
12 c=top_or_left(1,0)
13 d=top_or_left(1,1)
```

	a	True
	b	True
	c	True
globals	OR	lambda -> @10
	d	False
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2
stack		
heap		
definitions		

	a	True
	b	True
	c	True
globals	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2
stack		
heap		
definitions		

globals		
	a	True
	b	True
	c	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	False
	x	1
	y	1

heap

definitions

globals		
	a	True
	b	True
	c	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	1

heap

definitions

globals		
	a	True
	b	True
	c	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	1
	ret	False
	x	1
	y	1

heap

definitions

globals		
a		True
b		True
c		True
OR		lambda -> @10
left		lambda -> @4
top_or_left		lambda -> @9
up		lambda -> @2

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	1
	ret	null
	x	1
	y	1

heap

definitions

globals		
a		True
b		True
c		True
OR		lambda -> @10
left		lambda -> @4
top_or_left		lambda -> @9
up		lambda -> @2

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	1

heap

definitions

28

globals	a		True
	b		True
	c		True
	OR		lambda -> @10
	left		lambda -> @4
	top_or_left		lambda -> @9
	up		lambda -> @2

stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	1
		ret	False
		x	1
		y	1

heap
definitions

globals	a		True
	b		True
	c		True
	OR		lambda -> @10
	left		lambda -> @4
	top_or_left		lambda -> @9
	up		lambda -> @2

stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	1
		ret	null
		x	1
		y	1

heap
definitions

globals	a	True
	b	True
	c	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	1

heap

definitions

globals	a	True
	b	True
	c	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack

heap

definitions

globals	a	True
	b	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack

heap

definitions

globals		
	a	True
	b	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	True
	x	1
	y	0

heap

definitions

globals		
	a	True
	b	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	0

heap

definitions

globals		
	a	True
	b	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	0
	ret	False
	x	1
	y	0

heap

definitions

globals			
	a		True
	b		True
	OR		lambda -> @10
	left		lambda -> @4
	top_or_left		lambda -> @9
	up		lambda -> @2

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	1	
	y	0	
	ret	null	
	x	1	
	y	0	

heap

definitions

---

globals			
	a		True
	b		True
	OR		lambda -> @10
	left		lambda -> @4
	top_or_left		lambda -> @9
	up		lambda -> @2

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	1	
	y	0	

heap

definitions

---

globals			
	a		True
	b		True
	OR		lambda -> @10
	left		lambda -> @4
	top_or_left		lambda -> @9
	up		lambda -> @2

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	1	
	y	0	
	ret	True	
	x	1	
	y	0	

heap

definitions

globals	a		True
	b		True
	OR		lambda -> @10
	left		lambda -> @4
	top_or_left		lambda -> @9
	up		lambda -> @2
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	0
		ret	null
		x	1
		y	0
heap			
definitions			

globals	a		True
	b		True
	OR		lambda -> @10
	left		lambda -> @4
	top_or_left		lambda -> @9
	up		lambda -> @2
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	0
heap			
definitions			

globals	a	True
	b	True
	OR	lambda -> @10
	left	lambda -> @4
	top_or_left	lambda -> @9
	up	lambda -> @2
stack		
heap		
definitions		

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True
stack		
heap		
definitions		

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True
	p2	lambda -> @4
	p1	lambda -> @2
stack	ret	True
	x	0
	y	1
heap		
definitions		

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True
	p2	lambda -> @4
	p1	lambda -> @2
stack	ret	null
	x	0
	y	1
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True

	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	0
stack	y	1

	ret	True
	x	0
	y	1

heap

definitions

---

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True

	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	0
stack	y	1

	ret	null
	x	0
	y	1

heap

definitions

---

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True

	p2	lambda -> @4
	p1	lambda -> @2
stack	ret	null
	x	0
	y	1

heap

definitions

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	0
	y	1
	ret	False
	x	0
	y	1

heap

definitions

---

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	0
	y	1
	ret	null
	x	0
	y	1

heap

definitions

---

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	0
	y	1

heap

definitions

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
	a	True
stack		
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
stack		
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
stack	p2	lambda -> @4
	p1	lambda -> @2
	ret	True
	x	0
	y	0
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
stack	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	0
	y	0
heap		
definitions		

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9

	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	0	
stack	y	0	
		ret	True
		x	0
		y	0

heap

definitions

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9

	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	0	
stack	y	0	
		ret	null
		x	0
		y	0

heap

definitions

globals		
	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9

	p2	lambda -> @4
	p1	lambda -> @2
stack	ret	null
	x	0
	y	0

heap

definitions

globals	up	lambda -> @2	
	left	lambda -> @4	
	OR	lambda -> @10	
	top_or_left	lambda -> @9	
stack	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	0	
	y	0	
	ret	True	
	x	0	
	y	0	
heap			
definitions			

globals	up	lambda -> @2	
	left	lambda -> @4	
	OR	lambda -> @10	
	top_or_left	lambda -> @9	
stack	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	0	
	y	0	
	ret	null	
	x	0	
	y	0	
heap			
definitions			

globals	up	lambda -> @2	
	left	lambda -> @4	
	OR	lambda -> @10	
	top_or_left	lambda -> @9	
stack	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	0	
	y	0	
heap			
definitions			

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
	top_or_left	lambda -> @9
stack		
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
stack		
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
stack	ret	lambda -> @9
	p1	lambda -> @2
	p2	lambda -> @4
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
stack	ret	null
	p1	lambda -> @2
	p2	lambda -> @4
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
	OR	lambda -> @10
stack		
heap		
definitions		

globals	up	lambda -> @2
	left	lambda -> @4
stack		
heap		
definitions		

globals	up	lambda -> @2
stack		
heap		
definitions		

```
globals
stack
heap
definitions
```

2.2 And

Fill in the missing code blocks

```
1  left=lambda   x,y:(x==0)
2  top=lambda   x,y:(y==0)
3
4  AND=lambda            ,           :
5      lambda            ,           :
6          (            (           ,           ) and           (           ,           ))
7
8  left_and_top=AND(left,top)
9
10 a=left_and_top(0,0)
11 b=left_and_top(0,1)
12 c=left_and_top(1,0)
13 d=left_and_top(1,1)
```

	a	True
	b	False
	c	False
	d	False
globals	left	lambda -> @2
	top	lambda -> @4
	left_and_top	lambda -> @9
	AND	lambda -> @10
stack		
heap		
definitions		

	a	True
	b	False
	c	False
globals	left	lambda -> @2
	top	lambda -> @4
	left_and_top	lambda -> @9
	AND	lambda -> @10
stack		
heap		
definitions		

globals			
	a		True
	b		False
	c		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	False
		x	1
		y	1
heap			
definitions			

globals			
	a		True
	b		False
	c		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	1
heap			
definitions			

globals			
	a		True
	b		False
	c		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	1
stack		ret	False
		x	1
		y	1
heap			
definitions			

globals		
	a	True
	b	False
	c	False
	left	lambda -> @2
	top	lambda -> @4
	left_and_top	lambda -> @9
	AND	lambda -> @10

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	1
	ret	null
	x	1
	y	1

heap
definitions

globals		
	a	True
	b	False
	c	False
	left	lambda -> @2
	top	lambda -> @4
	left_and_top	lambda -> @9
	AND	lambda -> @10

stack		
	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	1
	y	1

heap
definitions

globals	a		True
	b		False
	c		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	1
		ret	False
		x	1
		y	1
heap			
definitions			

globals	a		True
	b		False
	c		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	1
		ret	null
		x	1
		y	1
heap			
definitions			

globals			
	a		True
	b		False
	c		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	1
heap			
definitions			

globals		
	a	True
	b	False
	c	False
	left	lambda -> @2
	top	lambda -> @4
	left_and_top	lambda -> @9
	AND	lambda -> @10
stack		
heap		
definitions		

globals		
	a	True
	b	False
	left	lambda -> @2
	top	lambda -> @4
	left_and_top	lambda -> @9
	AND	lambda -> @10
stack		
heap		
definitions		

globals			
	a		True
	b		False
	left	lambda -> @2	
	top	lambda -> @4	
	left_and_top	lambda -> @9	
	AND	lambda -> @10	

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret		False
	x		1
	y		0

heap
definitions

---

globals			
	a		True
	b		False
	left	lambda -> @2	
	top	lambda -> @4	
	left_and_top	lambda -> @9	
	AND	lambda -> @10	

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret		null
	x		1
	y		0

heap
definitions

---

globals			
	a		True
	b		False
	left	lambda -> @2	
	top	lambda -> @4	
	left_and_top	lambda -> @9	
	AND	lambda -> @10	

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret		null
	x		1
	y		0
	ret	True	
	x	1	
	y	0	

heap
definitions

globals			
	a		True
	b		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	1	
	y	0	
	ret	null	
	x	1	
	y	0	

heap

definitions

---

globals			
	a		True
	b		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	1	
	y	0	

heap

definitions

---

globals			
	a		True
	b		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10

stack			
	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	1	
	y	0	
	ret	False	
	x	1	
	y	0	

heap

definitions

globals	a		True
	b		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	1
		y	0
		ret	null
		x	1
		y	0
heap			
definitions			

globals	a		True
	b		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
stack		p2	lambda -> @4
		p1	lambda -> @2
	ret		null
	x		1
	y		0
heap			
definitions			

globals	a		True
	b		False
	left		lambda -> @2
	top		lambda -> @4
	left_and_top		lambda -> @9
	AND		lambda -> @10
stack			
heap			
definitions			

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
	a	True
stack		
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
	a	True
stack	p2	lambda -> @4
	p1	lambda -> @2
	ret	False
	x	0
	y	1
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
	a	True
stack	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	0
	y	1
heap		
definitions		

globals	left	lambda -> @2		
	top	lambda -> @4		
	AND	lambda -> @10		
	left_and_top	lambda -> @9		
	a		True	
stack		p2	lambda -> @4	
		p1	lambda -> @2	
		ret	null	
		x	0	
		y	1	
			ret	False
			x	0
			y	1
heap				
definitions				

globals	left	lambda -> @2		
	top	lambda -> @4		
	AND	lambda -> @10		
	left_and_top	lambda -> @9		
	a		True	
stack		p2	lambda -> @4	
		p1	lambda -> @2	
		ret	null	
		x	0	
		y	1	
			ret	null
			x	0
			y	1
heap				
definitions				

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
	a	True
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	0
		y	1
heap		
definitions		

51

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9

	a		True
		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	0
stack		y	1
		ret	True
		x	0
		y	1

heap
definitions

---

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9

	a		True
		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	0
stack		y	1
		ret	null
		x	0
		y	1

heap
definitions

---

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9

	a		True
		p2	lambda -> @4
		p1	lambda -> @2
stack		ret	null
		x	0
		y	1

heap
definitions

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
	a	True
stack		
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
stack		
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
stack	p2	lambda -> @4
	p1	lambda -> @2
	ret	True
	x	0
	y	0
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
stack	p2	lambda -> @4
	p1	lambda -> @2
	ret	null
	x	0
	y	0
heap		
definitions		

globals	left	lambda -> @2	
	top	lambda -> @4	
	AND	lambda -> @10	
	left_and_top	lambda -> @9	
stack	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	0	
	y	0	
	ret	True	
	x	0	
	y	0	
heap			
definitions			

globals	left	lambda -> @2	
	top	lambda -> @4	
	AND	lambda -> @10	
	left_and_top	lambda -> @9	
stack	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	0	
	y	0	
	ret	null	
	x	0	
	y	0	
heap			
definitions			

globals	left	lambda -> @2	
	top	lambda -> @4	
	AND	lambda -> @10	
	left_and_top	lambda -> @9	
stack	p2	lambda -> @4	
	p1	lambda -> @2	
	ret	null	
	x	0	
	y	0	
heap			
definitions			

globals	left	lambda -> @2	
	top	lambda -> @4	
	AND	lambda -> @10	
	left_and_top	lambda -> @9	
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	0
		y	0
		ret	True
		x	0
		y	0
heap			
definitions			

globals	left	lambda -> @2	
	top	lambda -> @4	
	AND	lambda -> @10	
	left_and_top	lambda -> @9	
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	0
		y	0
		ret	null
		x	0
		y	0
heap			
definitions			

globals	left	lambda -> @2	
	top	lambda -> @4	
	AND	lambda -> @10	
	left_and_top	lambda -> @9	
stack		p2	lambda -> @4
		p1	lambda -> @2
		ret	null
		x	0
		y	0
heap			
definitions			

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
	left_and_top	lambda -> @9
stack		
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
stack		
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
stack	ret	lambda -> @9
	p1	lambda -> @2
	p2	lambda -> @4
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
stack	ret	null
	p1	lambda -> @2
	p2	lambda -> @4
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
	AND	lambda -> @10
stack		
heap		
definitions		

globals	left	lambda -> @2
	top	lambda -> @4
stack		
heap		
definitions		

globals	left	lambda -> @2
stack		
heap		
definitions		

```
globals
stack
heap
definitions
```

2.3 Not

Fill in the missing state blocks.

```
1  def draw_grid (x_dim,y_dim,p):
2    res=""
3    x=0
4    y=0
5    while((y<y_dim)):
6      while((x<x_dim)):
7        if(p(x,y)):
8          res=(res+"#")
9        else:
10          res=(res+" ")
11        x=(x+1)
12      res=(res+"\n")
13      x=0
14      y=(y+1)
15    return res
16
17  NOT=lambda  p:lambda  x,y:(not p(x,y))
18
19  left=lambda  x,y:(x==0)
20  right=NOT(left)
21  res=draw_grid(2,2,right)
```

	NOT	lambda -> @6
globals	left	lambda -> @8
	right	lambda -> @5
	res	" #\n #\n"
stack		
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

res=" #\n #\n"

	NOT	lambda -> @6
globals	left	lambda -> @8
	right	lambda -> @5
stack		
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

	NOT	lambda -> @6
globals	left	lambda -> @8
	right	lambda -> @5
	ret	" #\n #\n"
	x_dim	2
	y_dim	2
stack	p	lambda -> @5
	res	" #\n #\n"
	x	0
	y	2
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

	NOT	lambda -> @6		
globals	left	lambda -> @8		
	right	lambda -> @5		
	ret	null		
	x_dim	2		
	y_dim	2		
stack	p	lambda -> @5		
	res	" #\n #\n"		
	x	0		
	y	2		
heap				
definitions	draw_grid	(x_dim,y_dim,p) => ...		

	NOT	lambda -> @6		
globals	left	lambda -> @8		
	right	lambda -> @5		
	ret	null		
	x_dim	2		
	y_dim	2		
stack	p	lambda -> @5		
	res	" #\n #\n"		
	x	0		
	y	2		
heap				
definitions	draw_grid	(x_dim,y_dim,p) => ...		

	NOT	lambda -> @6		
globals	left	lambda -> @8		
	right	lambda -> @5		
	ret	null		
	x_dim	2		
	y_dim	2		
stack	p	lambda -> @5		
	res	" #\n #\n"		
	x	0		
	y	1		
heap				
definitions	draw_grid	(x_dim,y_dim,p) => ...		

globals			
	NOT	lambda -> @6	
	left	lambda -> @8	
	right	lambda -> @5	

stack			
	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n #\n"	
	x	2	
	y	1	

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals			
	NOT	lambda -> @6	
	left	lambda -> @8	
	right	lambda -> @5	

stack			
	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n #"	
	x	2	
	y	1	

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals			
	NOT	lambda -> @6	
	left	lambda -> @8	
	right	lambda -> @5	

stack			
	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n #"	
	x	2	
	y	1	

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals		
	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack		
	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	
	x	1
	y	1

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals		
	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack		
	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	
	x	1
	y	1

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals		
	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack		
	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	" #\n "
	x	1
	y	1

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6	
	left	lambda -> @8	
	right	lambda -> @5	
stack	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n "	
	x	1	
	y	1	
	p	lambda -> @8	
	ret	True	
	x	1	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals	NOT	lambda -> @6	
	left	lambda -> @8	
	right	lambda -> @5	
stack	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n "	
	x	1	
	y	1	
	p	lambda -> @8	
	ret	null	
	x	1	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

	NOT	lambda -> @6	
globals	left	lambda -> @8	
	right	lambda -> @5	
	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n "	
	x	1	
	y	1	
stack	p	lambda -> @8	
	ret	null	
	x	1	
	y	1	
	ret	False	
	x	1	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

	NOT	lambda -> @6	
globals	left	lambda -> @8	
	right	lambda -> @5	
	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n "	
	x	1	
	y	1	
stack	p	lambda -> @8	
	ret	null	
	x	1	
	y	1	
	ret	null	
	x	1	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

	NOT	lambda ->	@6
globals	left	lambda ->	@8
	right	lambda ->	@5
	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda ->	@5
	res	" #\n "	
stack	x	1	
	y	1	
	p	lambda ->	@8
	ret	null	
	x	1	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

	NOT	lambda ->	@6
globals	left	lambda ->	@8
	right	lambda ->	@5
	ret	null	
	x_dim	2	
	y_dim	2	
stack	p	lambda ->	@5
	res	" #\n "	
	x	1	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

	NOT	lambda ->	@6
globals	left	lambda ->	@8
	right	lambda ->	@5
	ret	null	
	x_dim	2	
	y_dim	2	
stack	p	lambda ->	@5
	res	" #\n "	
	x	1	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals	NOT	lambda -> @6	
	left	lambda -> @8	
	right	lambda -> @5	
stack	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n "	
	x	0	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals	NOT	lambda -> @6	
	left	lambda -> @8	
	right	lambda -> @5	
stack	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n"	
	x	0	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals	NOT	lambda -> @6	
	left	lambda -> @8	
	right	lambda -> @5	
stack	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	" #\n"	
	x	0	
	y	1	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals		
	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack		
	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	" #\n"
	x	0
	y	1
	p	lambda -> @8
	ret	False
	x	0
	y	1

heap

definitions	draw_grid (x_dim,y_dim,p) => ...

globals		
	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack		
	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	" #\n"
	x	0
	y	1
	p	lambda -> @8
	ret	null
	x	0
	y	1

heap

definitions	draw_grid (x_dim,y_dim,p) => ...

```
                       NOT     lambda -> @6
       globals         left    lambda -> @8
                       right   lambda -> @5
                        ret          null
                        x_dim          2
                        y_dim          2
                        p       lambda -> @5
                        res        " #\n"
                        x             0
                        y             1
       stack
                         p      lambda -> @8
                         ret         null
                         x            0
                         y            1

                          ret   True
                          x      0
                          y      1
       heap
       definitions     draw_grid   (x_dim ,y_dim ,p) => ...
```

```
                       NOT     lambda -> @6
       globals         left    lambda -> @8
                       right   lambda -> @5
                        ret          null
                        x_dim          2
                        y_dim          2
                        p       lambda -> @5
                        res        " #\n"
                        x             0
                        y             1
       stack
                         p      lambda -> @8
                         ret         null
                         x            0
                         y            1

                          ret   null
                          x      0
                          y      1
       heap
       definitions     draw_grid   (x_dim ,y_dim ,p) => ...
```

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5
	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	" #\n"
stack	x	0
	y	1
	p	lambda -> @8
	ret	null
	x	0
	y	1
heap		
definitions	draw_grid (x_dim,y_dim,p) => ...	

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5
	ret	null
	x_dim	2
	y_dim	2
stack	p	lambda -> @5
	res	" #\n"
	x	0
	y	1
heap		
definitions	draw_grid (x_dim,y_dim,p) => ...	

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5
	ret	null
	x_dim	2
	y_dim	2
stack	p	lambda -> @5
	res	" #\n"
	x	0
	y	1
heap		
definitions	draw_grid (x_dim,y_dim,p) => ...	

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

	ret	null
	x_dim	2
	y_dim	2
stack	p	lambda -> @5
	res	" #\n"
	x	0
	y	1

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

	ret	null
	x_dim	2
	y_dim	2
stack	p	lambda -> @5
	res	" #\n"
	x	0
	y	0

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

	ret	null
	x_dim	2
	y_dim	2
stack	p	lambda -> @5
	res	" #\n"
	x	2
	y	0

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

```
                            NOT     lambda -> @6
        globals             left    lambda -> @8
                            right   lambda -> @5
                            ret         null
                            x_dim        2
                            y_dim        2
        stack               p       lambda -> @5
                            res        " #"
                            x            2
                            y            0
        heap
        definitions     draw_grid  (x_dim,y_dim,p) => ...

                            NOT     lambda -> @6
        globals             left    lambda -> @8
                            right   lambda -> @5
                            ret         null
                            x_dim        2
                            y_dim        2
        stack               p       lambda -> @5
                            res        " #"
                            x            2
                            y            0
        heap
        definitions     draw_grid  (x_dim,y_dim,p) => ...

                            NOT     lambda -> @6
        globals             left    lambda -> @8
                            right   lambda -> @5
                            ret         null
                            x_dim        2
                            y_dim        2
        stack               p       lambda -> @5
                            res
                            x            1
                            y            0
        heap
        definitions     draw_grid  (x_dim,y_dim,p) => ...
```

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5
stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5
stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	" "
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5
stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	" "
	x	1
	y	0
	p	lambda -> @8
	ret	True
	x	1
	y	0
heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

		NOT	lambda -> @6	
globals		left	lambda -> @8	
		right	lambda -> @5	
		ret	null	
		x_dim	2	
		y_dim	2	
		p	lambda -> @5	
		res	" "	
stack		x	1	
		y	0	
		p	lambda -> @8	
		ret	null	
		x	1	
		y	0	
heap				
definitions		draw_grid	(x_dim,y_dim,p) => ...	

		NOT	lambda -> @6	
globals		left	lambda -> @8	
		right	lambda -> @5	
		ret	null	
		x_dim	2	
		y_dim	2	
		p	lambda -> @5	
		res	" "	
		x	1	
		y	0	
stack		p	lambda -> @8	
		ret	null	
		x	1	
		y	0	
		ret	False	
		x	1	
		y	0	
heap				
definitions		draw_grid	(x_dim,y_dim,p) => ...	

		NOT	lambda -> @6
globals		left	lambda -> @8
		right	lambda -> @5
		ret	null
		x_dim	2
		y_dim	2
		p	lambda -> @5
		res	" "
		x	1
		y	0
stack		p	lambda -> @8
		ret	null
		x	1
		y	0
		ret	null
		x	1
		y	0
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

		NOT	lambda -> @6
globals		left	lambda -> @8
		right	lambda -> @5
		ret	null
		x_dim	2
		y_dim	2
		p	lambda -> @5
		res	" "
		x	1
stack		y	0
		p	lambda -> @8
		ret	null
		x	1
		y	0
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	" "
	x	1
	y	0

heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	" "
	x	1
	y	0

heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	
	x	0
	y	0

heap		
definitions	draw_grid	(x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	
	x	0
	y	0

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	""
	x	0
	y	0

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

globals	NOT	lambda -> @6
	left	lambda -> @8
	right	lambda -> @5

stack	ret	null
	x_dim	2
	y_dim	2
	p	lambda -> @5
	res	""
	x	0
	y	0
	p	lambda -> @8
	ret	False
	x	0
	y	0

heap

definitions   draw_grid (x_dim,y_dim,p) => ...

	NOT	lambda -> @6	
globals	left	lambda -> @8	
	right	lambda -> @5	
	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	""	
stack	x	0	
	y	0	
	p	lambda -> @8	
	ret	null	
	x	0	
	y	0	
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

	NOT	lambda -> @6	
globals	left	lambda -> @8	
	right	lambda -> @5	
	ret	null	
	x_dim	2	
	y_dim	2	
	p	lambda -> @5	
	res	""	
	x	0	
	y	0	
stack	p	lambda -> @8	
	ret	null	
	x	0	
	y	0	
		ret	True
		x	0
		y	0
heap			
definitions	draw_grid	(x_dim,y_dim,p) => ...	

76

		NOT	lambda -> @6	
globals		left	lambda -> @8	
		right	lambda -> @5	
		ret		null
		x_dim		2
		y_dim		2
		p	lambda -> @5	
		res		""
		x		0
		y		0
stack		p	lambda -> @8	
		ret		null
		x		0
		y		0
			ret	null
			x	0
			y	0
heap				
definitions	draw_grid	(x_dim,y_dim,p) => ...		

		NOT	lambda -> @6	
globals		left	lambda -> @8	
		right	lambda -> @5	
		ret		null
		x_dim		2
		y_dim		2
		p	lambda -> @5	
		res		""
stack		x		0
		y		0
		p	lambda -> @8	
		ret		null
		x		0
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	NOT	lambda -> @6	
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	x_dim	2	
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stack	p	lambda -> @5	
	res	""	
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globals		NOT	lambda ->	@6
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globals		NOT	lambda ->	@6
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globals		NOT	lambda ->	@6
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