INFDEV02-2 Homework 3

Dev Team

Abstraction, functions, recursion, and data structures.

Contents

- Lecture Homework 3 Lines
 - Draw line, p.2
 - Repeat, p.6
- Lecture Homework 3 Squares
 - Draw line, p.10
 - Repeat, p.24
- Lecture Homework 3 Triangles
 - Draw line, p.41
 - Repeat, p.67

Lecture Homework 3 - Lines

Draw line Fill in the missing code blocks

```
def draw_line (
                              ):
1
     res=""
2
3
     while((n>
                         )):
4
       res=(res+
                            )
5
       n = (n -
                       )
6
     return
8 res=draw_line(3)
 |print (
```

```
globals
stack
heap
definitions
globals
stack
heap
definitions
               draw_line
                           (n) => ...
globals
                       ret
                            null
stack
                              3
heap
definitions
               draw_line
                           (n) => ...
globals
                       ret
                            null
                              3
stack
                       n
                             " "
                       res
heap
definitions
               draw_line
                           (n) => ...
globals
                       ret
                            null
stack
                              3
                       n
                       res
heap
definitions
               draw_line
                           (n) => ...
```

ret	null	
n	3	
res	"*"	_
draw_line	(n) =>	
ret	null	
n	2	
res	"*"	_
draw_line	(n) =>	
ret	null	
n	2	
res	"*"	
		_
draw_line	(n) =>	
ret	null	
n	2	
res	"**"	
		=
draw_line	(n) =>	
ret	null	
n	1	
res	"**"	
		_
draw_line	(n) =>	
ret	null	
n	1	
res	"**"	
		_
draw_line	(n) =>	
	n res	<pre>n 3 res "*" draw_line (n) => ret null n 2 res "*" draw_line (n) => ret null n 2 res "*" draw_line (n) => ret null n 2 res "**" draw_line (n) => ret null n 2 res "**" draw_line (n) => ret null n 2 res "**" draw_line (n) => ret null n 1 res "**"</pre>

ret null res ret null res ret null res ret r			
stack n 1 heap definitions draw_line (n) => globals ret null stack n 0 res "***" heap definitions draw_line (n) => stack n 0 res "***" heap definitions draw_line (n) => n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) => definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	globals		
res "***" heap definitions draw_line (n) => globals ret null stack n 0 res "***" heap definitions draw_line (n) => globals ret null stack n 0 res "***" heap definitions draw_line (n) => globals ret "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>		ret	null
heap definitions draw_line (n) => globals ret null stack n 0 res "***" heap definitions draw_line (n) => globals ret null stack n 0 res "***" heap definitions draw_line (n) => globals ret "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	stack	n	1
definitions draw_line (n) => globals ret null stack n 0 res "***" heap draw_line (n) => globals ret null stack n 0 res "***" heap draw_line (n) => globals ret "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>		res	"***"
globals ret null stack n 0 res "***" heap (n) => globals ret null stack n 0 res "***" heap (n) => globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	heap		
ret null stack n 0 res "***" heap definitions (n) => globals ret null stack n 0 res "***" heap tret "***" heap definitions draw_line (n) => globals tret "***" stack n 0 res heap definitions draw_line (n) =>	definitions	draw_line	(n) =>
stack n 0 heap definitions draw_line (n) => globals ret null n stack n 0 res "***" heap definitions draw_line (n) => globals ret "***" heap definitions draw_line (n) => globals stack n 0 globals draw_line (n) => globals draw_line (n) => globals stack n 0 globals globals globals globals definitions draw_line (n) =>	globals		
res "***" heap draw_line (n) => globals ret null stack n 0 res "***" heap draw_line (n) => globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>		ret	null
heap definitions draw_line (n) => globals ret null n 0 n 0 n n 0 <t< td=""><td>stack</td><td>n</td><td>0</td></t<>	stack	n	0
definitions draw_line (n) => globals ret null n 0 stack n 0 res "***" heap definitions draw_line (n) => globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>		res	"***"
globals ret null stack n 0 res "***" heap draw_line (n) => globals ret "***" stack n 0 res "***" heap draw_line (n) => globals stack heap definitions draw_line (n) =>	heap		
stack ret null not not new "***" heap definitions draw_line (n) => globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) => definitions draw_line (n) =>	definitions	draw_line	(n) =>
stack n 0 res "***" heap draw_line (n) => globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	globals		
res "***" heap draw_line (n) => globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>		ret	null
heap draw_line (n) => globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	stack	n	0
definitions draw_line (n) => globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>		res	"***"
globals ret "***" stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	heap		
stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	definitions	draw_line	(n) =>
stack n 0 res "***" heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	globals		
<pre>heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =></pre>		ret	"***"
heap definitions draw_line (n) => globals stack heap definitions draw_line (n) =>	stack	n	0
<pre>definitions draw_line (n) => globals stack heap definitions draw_line (n) =></pre>		res	"***"
<pre>definitions draw_line (n) => globals stack heap definitions draw_line (n) =></pre>	heap	<u> </u>	
<pre>globals stack heap definitions draw_line (n) =></pre>	-	draw_line	(n) =>
<pre>stack heap definitions draw_line (n) =></pre>	globals		
definitions draw_line (n) =>			
definitions draw_line (n) =>	heap		
	-	draw_line	(n) =>
-	globals		"***"
stack	_		
heap	heap		
definitions draw_line (n) =>	-	draw line	(n) =>

```
globals res "***"
stack
heap
definitions draw_line (n) => ...
output "***"
```

Repeat Fill in the missing code blocks

```
1 \mid \mathtt{def} repeat (
                                           ):
2
     res=
3 |
     while((n>
                            )):
                    =(res+symbol)
4
        n=(n-1)
5
6
     return
7
                    ("#",3)
8 | res=
  |print (
                        )
```

```
globals
stack
heap
definitions
globals
stack
{\tt heap}
definitions
                repeat (symbol,n) => ...
globals
                                 null
                        ret
                                  "#"
stack
                        symbol
                                   3
heap
definitions
                repeat
                        (symbol,n) => \dots
globals
                                 null
                        ret
                                  "#"
                        symbol
stack
                                   3
                        n
                                   11 11
                        res
heap
                         (symbol,n) => ...
{\tt definitions}
                repeat
```

globals				
		ret	null	
		symbol	"#"	
stack		n	3	
		res	" "	
heap				-
definitions	repeat	(symbol	l,n) =>	
globals	-			
0		ret	null	
		symbol	"#"	
stack		n	3	
		res	"#"	
heap		100	n-	-
definitions	repeat	(symbol	L,n) =>	
globals	repear	(Bymbo.	1,11) ->	• • •
giobais		ret	null	
			"#"	
stack		symbol		
		n	2	
		res	"#"	-
heap		,		
definitions	repeat	(symbol	L,n) =>	• • •
globals				
		ret	null	
stack		symbol	"#"	
		n	2	
		res	"#"	=
heap				
definitions	repeat	(symbol	l,n) =>	
globals				
stack		ret	null	
		symbol	"#"	
		n	2	
		res	"##"	
heap				-
definitions	repeat	(symbol,n) =>		
	-			

globals				
		ret	null	
		symbol	"#"	
stack		n	1	
		res	"##"	
heap				
definitions	repeat	(symbo	1,n) =>	
globals	-	-		
		ret	null	
		symbol	"#"	
stack		n	1	
		res	"##"	
heap				
definitions	repeat	(symbo	1,n) =>	
globals	-			
		ret	null	
		symbol	"#"	
stack		n	1	
		res	"###"	
heap				_
definitions	repeat	(symbo	1,n) =>	
globals				
		ret	null	
		symbol	"#"	
stack		n	0	
		res	"###"	
heap				_
definitions	repeat	(symbo	1,n) =>	
globals				
-		ret	null	
stack		symbol	"#"	
		n	0	
		res	"###"	
heap				-
definitions	repeat	(symbol,n) =>		
	· r v	, j	, , .	-

globals					
		ret	"##	#"	
-41-		symbo	1 "#	11	
stack		n	0		
		res	"##	#"	_
heap					
definitions	repeat	(sym	bol,n)	=>	
globals					
stack					
heap					
definitions	repeat	(sym	bol,n)	=>	
globals		res "###"			
stack					
heap					
definitions	repeat	(sym	bol,n)	=>	
globals		res	"###"		
stack					
heap					
definitions	repeat	(symbol,n) =>			
output		"###"			

Lecture Homework 3 - Squares

Square Fill in the missing code blocks

```
def repeat (symbol,n):
2
     res=""
3
     while ((n>0)):
       res=(res+symbol)
4
5
       n = (n-1)
6
     return res
7
  def draw_line (n):
9
     return repeat("*",
                                   )
10
  def draw_square (n):
11
12
     l=(draw_line(
                              ) +"\n")
13
     return repeat (
14
15
   res=draw_square(3)
16
                     )
17
  |print (
```

```
globals
stack
heap
definitions
globals
stack
heap
definitions
               repeat (symbol,n) => ...
globals
stack
heap
               repeat
                           (symbol,n) => \dots
definitions
                               (n) => ...
               draw_line
globals
stack
heap
               repeat
                             (symbol,n) => \dots
definitions
               draw_line
                                 (n) => ...
               draw_square
                                 (n) => ...
```

```
globals
                              ret null
stack
                              n
                                      3
heap
                                (symbol,n) \Rightarrow \dots
                repeat
definitions
                draw_line
                                    (n) => ...
                draw_square
                                    (n) \Rightarrow \dots
globals
                              ret
                                    null
                                      3
{\tt stack}
                                   null
                              ret
                                      3
                              n
heap
                repeat
                                (symbol,n) \Rightarrow \dots
definitions
                draw_line
                                    (n) => ...
                                    (n) => ...
                draw_square
globals
                            ret
                                      null
                                      "*"
                            symbol
                                       3
                              ret
                                    null
stack
                                      3
                              n
                                    null
                              ret
                                      3
heap
                repeat
                                (symbol,n) \Rightarrow \dots
definitions
                draw_line
                                    (n) => ...
                draw_square
                                    (n) => ...
```

```
globals
                           ret
                                    null
                           symbol
                                     "*"
                                      3
                           res
stack
                             ret null
                                    3
                             ret
                                  null
                                    3
                             n
heap
                               (symbol,n) => ...
                repeat
definitions
                draw_line
                                   (n) => ...
                draw_square
                                   (n) => ...
{\tt globals}
                           ret
                                    null
                                     "*"
                           symbol
                                      3
                           n
                                      11 11
                           res
stack
                             ret
                                  null
                                    3
                             n
                                  null
                             ret
                                    3
                             n
heap
                repeat
                               (symbol,n) \Rightarrow \dots
definitions
                draw_line
                                   (n) => ...
                draw_square
                                   (n) => ...
```

```
globals
                          ret
                                   null
                          symbol
                                   "*"
                                    3
                                   "*"
                          res
stack
                           ret null
                                   3
                            ret
                                 null
                                   3
                            n
heap
                             (symbol,n) => ...
               repeat
definitions
               draw_line
                                 (n) => ...
                                 (n) => ...
               draw_square
{\tt globals}
                          ret
                                   null
                                   "*"
                          symbol
                                    2
                          n
                                   "*"
                          res
stack
                            ret
                                 null
                                   3
                           n
                                 null
                           ret
                                   3
                            n
heap
                             (symbol,n) => ...
               repeat
definitions
               draw_line
                                 (n) => ...
               draw_square
                                 (n) => ...
```

```
globals
                          ret
                                   null
                          symbol
                                   "*"
                                    2
                                   "*"
                          res
stack
                           ret null
                                   3
                            ret
                                 null
                                   3
                            n
heap
                             (symbol,n) => ...
               repeat
definitions
               draw_line
                                 (n) => ...
                                 (n) => ...
               draw_square
{\tt globals}
                          ret
                                   null
                                   "*"
                          symbol
                                    2
                          n
                                   "**"
                          res
stack
                            ret
                                 null
                                   3
                           n
                                 null
                           ret
                                   3
                            n
heap
                             (symbol,n) => ...
               repeat
definitions
               draw_line
                                 (n) => ...
               draw_square
                                 (n) => ...
```

```
globals
                           ret
                                    null
                           symbol
                                    "*"
                                     1
                                    "**"
                           res
stack
                            ret null
                                    3
                            ret
                                  null
                                    3
                            n
heap
                              (symbol,n) => ...
               repeat
definitions
               draw_line
                                  (n) => ...
               draw_square
                                  (n) \Rightarrow \dots
{\tt globals}
                           ret
                                    null
                                    "*"
                           symbol
                                     1
                           n
                                    "**"
                           res
stack
                            ret
                                 null
                                    3
                            n
                                  null
                            ret
                                    3
                            n
heap
                              (symbol,n) => ...
               repeat
definitions
               draw_line
                                  (n) => ...
               draw_square
                                  (n) => ...
```

```
globals
                           ret
                                     null
                           symbol
                                     "*"
                                       1
                                    "***"
                           res
stack
                             ret null
                                     3
                             ret
                                   null
                                     3
                             n
heap
                               (symbol,n) => ...
                repeat
definitions
                draw_line
                                   (n) => ...
                draw_square
                                   (n) \Rightarrow \dots
{\tt globals}
                           ret
                                     null
                                     "*"
                           symbol
                                       0
                           n
                                    "***"
                           res
stack
                             ret
                                   null
                                     3
                             n
                                   null
                             ret
                                     3
                             n
heap
                repeat
                               (symbol,n) \Rightarrow \dots
definitions
                draw_line
                                   (n) => ...
                draw_square
                                   (n) => ...
```

```
globals
                         ret
                                   null
                         symbol
                                   "*"
                         n
                         res
                                  "***"
stack
                           ret null
                                   3
                           ret
                                 null
                                   3
                           n
heap
                             (symbol,n) => ...
               repeat
definitions
               draw_line
                                 (n) =>
               draw_square
                                 (n) =>
globals
                         ret
                                  "***"
                                   "*"
                         symbol
                         n
                                    0
                                  "***"
                         res
stack
                           ret
                                 null
                                   3
                           n
                                 null
                           ret
                                   3
                           n
heap
               repeat
                             (symbol,n) => ...
definitions
               draw_line
                                 (n) => ...
               draw_square
                                 (n) => ...
globals
                                 null
                           ret
                                   3
                           n
stack
                           ret
                                 null
                                   3
heap
                             (symbol,n) => ...
               repeat
definitions
                                 (n) => ...
               draw_line
               draw_square
                                 (n) => ...
```

```
globals
                               ret
                                     "***"
                              n
                                       3
{\tt stack}
                               ret
                                     null
                                       3
                               n
heap
                 repeat
                                 (symbol,n) \Rightarrow \dots
definitions
                 draw_line
                                     (n) => ...
                 draw_square
                                      (n) => ...
globals
                               ret
                                     null
stack
                                       3
                               n
heap
                                 (symbol,n) \Rightarrow \dots
                 repeat
definitions
                 draw_line
                                     (n) =>
                 draw_square
                                      (n) => ...
globals
                             ret
                                     null
stack
                             n
                                       3
                             1
                                    "***\n"
heap
                 repeat
                                 (symbol,n) \Rightarrow \dots
                 draw_line
definitions
                                     (n) \Rightarrow \dots
                 draw_square
                                      (n) => ...
globals
                            ret
                                       null
                            symbol
                                      "***\n"
stack
                             ret
                                     null
                             n
                                       3
                                    "***\n"
                             1
heap
                 repeat
                                 (symbol,n) => ...
definitions
                 draw_line
                                     (n) \Rightarrow \dots
                 draw_square
                                     (n) \Rightarrow \dots
```

```
globals
                          ret
                                      null
                          symbol
                                    "***\n"
                                       3
                                       11 11
                          res
stack
                            ret
                                    null
                                      3
                            n
                            1
                                  "***\n"
heap
                                (symbol,n) => ...
                repeat
definitions
                draw_line
                                    (n) => ...
                draw_square
                                    (n) => ...
globals
                          ret
                                      null
                          symbol
                                    "***\n"
                                       3
                          n
                                       11 11
stack
                          res
                            ret
                                    null
                            n
                                      3
                                  "***\n"
heap
                repeat
                                (symbol,n) => \dots
                draw_line
definitions
                                    (n) \Rightarrow \dots
                draw_square
                                    (n) => ...
globals
                          ret
                                     null
                                    "***\n"
                          symbol
                                       3
                                    "***\n"
stack
                          res
                            ret
                                    null
                            n
                                      3
                                  "***\n"
heap
                                (symbol,n) \Rightarrow \dots
                repeat
                draw_line
                                    (n) \Rightarrow \dots
definitions
                draw_square
                                    (n) => ...
```

```
globals
                          ret
                                     null
                          symbol
                                   "***\n"
                                   "***\n"
stack
                          res
                            ret
                                   null
                                     3
                            n
                            1
                                  "***\n"
heap
                               (symbol,n) => ...
                repeat
definitions
                draw_line
                                   (n) => ...
                draw_square
                                   (n) => ...
globals
                          ret
                                     null
                          symbol
                                   "***\n"
                                       2
                                   "***\n"
stack
                          res
                                   null
                            ret
                            n
                                     3
                                  "***\n"
heap
                repeat
                               (symbol,n) => \dots
                draw_line
definitions
                                   (n) \Rightarrow \dots
                draw_square
                                   (n) => ...
globals
                       ret
                                     null
                                   "***\n"
                       symbol
                                       2
                                 "***\n***\n"
stack
                       res
                            ret
                                   null
                            n
                                     3
                                  "***\n"
heap
                               (symbol,n) \Rightarrow \dots
                repeat
                draw_line
                                   (n) \Rightarrow \dots
definitions
                draw_square
                                   (n) => ...
```

```
globals
                       ret
                                     null
                       symbol
                                   "***\n"
                                "***\n***\n"
stack
                       res
                            ret
                                   null
                                     3
                            n
                            1
                                  "***\n"
heap
                repeat
                               (symbol,n) => \dots
definitions
                draw_line
                                   (n) => ...
                draw_square
                                   (n) => ...
globals
                       ret
                                     null
                       symbol
                                   "***\n"
                                       1
                       n
                                "***\n***\n"
stack
                       res
                                   null
                            ret
                            n
                                     3
                                  "***\n"
heap
                repeat
                               (symbol,n) => \dots
                draw_line
definitions
                                   (n) \Rightarrow \dots
                draw_square
                                   (n) => ...
globals
                    ret
                                     null
                                   "***\n"
                    symbol
                                       1
                             "***\n***\n***\n"
stack
                    res
                            ret
                                   null
                            n
                                     3
                                  "***\n"
heap
                               (symbol,n) \Rightarrow \dots
                repeat
                draw_line
                                   (n) \Rightarrow \dots
definitions
                draw_square
                                   (n) => ...
```

```
globals
                    ret
                                     null
                    symbol
                                   "***\n"
                                      0
                             "***\n***\n***\n"
stack
                    res
                           ret
                                   null
                                     3
                           n
                           1
                                 "***\n"
heap
                               (symbol,n) => \dots
                repeat
definitions
                draw_line
                                   (n) => ...
                draw_square
                                   (n) => ...
globals
                    ret
                                     null
                    symbol
                                   "***\n"
                                      0
                    n
                             "***\n***\n***\n"
stack
                    res
                                   null
                           ret
                           n
                                     3
                                 "***\n"
heap
                repeat
                               (symbol,n) => \dots
                draw_line
definitions
                                   (n) \Rightarrow \dots
                draw_square
                                   (n) => ...
globals
                    ret
                             "***\n***\n***\n"
                                   "***\n"
                    symbol
                                      0
                              "***\n***\n***\n"
stack
                    res
                           ret
                                   null
                           n
                                     3
                                 "***\n"
heap
                repeat
                               (symbol,n) \Rightarrow \dots
                draw_line
                                   (n) \Rightarrow \dots
definitions
                                   (n) => ...
                draw_square
```

```
globals
                                    null
                            ret
stack
                                      3
                            n
                                   "***\n"
heap
                repeat
                                (symbol,n) \Rightarrow \dots
                                    (n) \Rightarrow \dots
definitions
                draw_line
                draw_square
                                    (n) => ...
globals
                            "***\n***\n***\n"
                      ret
                                      3
stack
                      n
                                   "***\n"
                      1
heap
                repeat
                                (symbol,n) => \dots
definitions
                draw_line
                                    (n) \Rightarrow \dots
                                    (n) => ...
                draw_square
globals
stack
heap
                repeat
                                (symbol,n) => \dots
definitions
                draw_line
                                    (n) => ...
                draw_square
                                    (n) \Rightarrow \dots
globals
                          "***\n***\n***\n"
stack
heap
                repeat
                                (symbol,n) => \dots
                draw_line
                                    (n) \Rightarrow \dots
definitions
                draw_square
                                    (n) => ...
                           "***\n***\n***\n"
globals
                     res
stack
heap
                repeat
                                (symbol,n) => \dots
definitions
                draw_line
                                    (n) \Rightarrow \dots
                draw_square
                                    (n) => ...
                        "***\n***\n***\n"
output
```

Empty square Fill in the missing code blocks

```
def repeat (symbol,n):
1
     res=""
2
3
     while ((n>0)):
4
       res=(res+symbol)
5
       n=(n-1)
6
     return res
7
8
  def draw_line (n):
9
10
     return repeat("*",
11
12 def draw_empty_square (n):
                             ) +"\n")
     l=(draw_line(
13
                            +(repeat(" ",(n-2)) +"*\n"))
14
     empty_line=(
15
     return (
                        +(repeat(empty_line,(n-
                                                          )) +
                ))
16
17
18 | res=draw_empty_square(
                                     )
19
  print (
                    )
```

```
globals
stack
heap
definitions
globals
stack
heap
definitions
              repeat (symbol,n) => ...
globals
stack
heap
               repeat
                          (symbol,n) => \dots
definitions
               draw_line
                              (n) => ...
```

```
globals
stack
heap
                                          (symbol,n) \Rightarrow \dots
                  repeat
definitions
                  draw_line
                                              (n) \Rightarrow \dots
                  draw_empty_square
                                              (n) => ...
globals
                                    ret
                                          null
stack
                                            3
                                    n
heap
                                          (symbol,n) => ...
                  repeat
definitions
                  draw_line
                                              (n) \Rightarrow \dots
                  draw_empty_square
                                              (n) \Rightarrow \dots
globals
                                          null
                                    ret
                                            3
                                    n
stack
                                          null
                                    ret
                                    n
heap
                  repeat
                                          (symbol,n) \Rightarrow \dots
                  draw_line
                                              (n) \Rightarrow \dots
definitions
                  draw_empty_square
                                              (n) => ...
globals
                                  ret
                                            null
                                             "*"
                                  symbol
                                              3
stack
                                          null
                                    ret
                                            3
                                          null
                                    ret
                                            3
                                    n
heap
                                          (symbol,n) => ...
                  repeat
                  draw_line
definitions
                                               (n) \Rightarrow \dots
                  draw_empty_square
                                              (n) \Rightarrow \dots
```

```
globals
                              ret
                                       null
                               symbol
                                        "*"
                                         3
                               res
stack
                                ret null
                                        3
                                ret
                                      null
                                        3
                                n
heap
                repeat
                                      (symbol,n) => \dots
definitions
                draw_line
                                         (n) => ...
                draw_empty_square
                                          (n) \Rightarrow \dots
globals
                                       null
                              ret
                                        "*"
                               symbol
                                         3
                              n
                                         11 11
                              res
stack
                                ret
                                      null
                                        3
                                n
                                      null
                                ret
                                        3
                                n
heap
                repeat
                                      (symbol,n) => ...
definitions
                draw_line
                                         (n) => ...
                draw_empty_square
                                          (n) => ...
```

```
globals
                               ret
                                        null
                               symbol
                                         "*"
                                          3
                                         "*"
                               res
stack
                                ret null
                                        3
                                ret
                                      null
                                        3
                                 n
heap
                repeat
                                      (symbol,n) \Rightarrow \dots
definitions
                draw_line
                                          (n) => ...
                draw_empty_square
                                          (n) \Rightarrow \dots
globals
                                        null
                               ret
                                         "*"
                               symbol
                                          2
                               n
                                         "*"
                               res
stack
                                 ret
                                      null
                                        3
                                n
                                      null
                                ret
                                        3
                                 n
heap
                                      (symbol,n) => ...
                repeat
definitions
                draw_line
                                          (n) => ...
                draw_empty_square
                                          (n) => ...
```

```
globals
                               ret
                                        null
                               symbol
                                         "*"
                                          2
                                         "*"
                               res
stack
                                ret null
                                        3
                                ret
                                      null
                                        3
                                 n
heap
                repeat
                                      (symbol,n) \Rightarrow \dots
definitions
                draw_line
                                          (n) => ...
                draw_empty_square
                                          (n) \Rightarrow \dots
globals
                                        null
                               ret
                                         "*"
                               symbol
                                          2
                               n
                                        "**"
                               res
stack
                                 ret
                                      null
                                        3
                                n
                                      null
                                ret
                                        3
                                 n
heap
                repeat
                                      (symbol,n) => ...
definitions
                draw_line
                                          (n) => ...
                draw_empty_square
                                          (n) => ...
```

```
globals
                               ret
                                        null
                               symbol
                                        "*"
                                          1
                                        "**"
                               res
stack
                                ret null
                                        3
                                ret
                                      null
                                        3
                                n
heap
                repeat
                                      (symbol,n) \Rightarrow \dots
definitions
                draw_line
                                          (n) => ...
                draw_empty_square
                                          (n) \Rightarrow \dots
globals
                               ret
                                        null
                                        "*"
                               symbol
                                          1
                               n
                                        "**"
                               res
stack
                                ret
                                      null
                                        3
                                n
                                      null
                                ret
                                        3
                                n
heap
                repeat
                                      (symbol,n) => ...
definitions
                draw_line
                                          (n) => ...
                draw_empty_square
                                          (n) => ...
```

```
globals
                              ret
                                        null
                              symbol
                                        "*"
                                         1
                                       "***"
                              res
stack
                                ret null
                                        3
                                ret
                                      null
                                        3
                                n
heap
                repeat
                                      (symbol,n) \Rightarrow \dots
definitions
                draw_line
                                          (n) => ...
                draw_empty_square
                                          (n) \Rightarrow \dots
globals
                                        null
                              ret
                                        "*"
                              symbol
                                         0
                              n
                                       "***"
                              res
stack
                                ret
                                      null
                                        3
                                n
                                      null
                                ret
                                        3
                                n
heap
                                      (symbol,n) => ...
                repeat
definitions
                draw_line
                                          (n) => ...
                draw_empty_square
                                          (n) => ...
```

```
globals
                              ret
                                       null
                              symbol
                              res
                                       "***"
stack
                                ret null
                                       3
                                ret
                                     null
                                       3
                                n
heap
                                     (symbol,n) => \dots
                repeat
definitions
                draw_line
                                         (n) =>
                draw_empty_square
                                         (n) =>
globals
                              ret
                                       "***"
                                        "*"
                              symbol
                              n
                                         0
                                       "***"
                              res
stack
                                ret
                                     null
                                       3
                                n
                                      null
                                ret
                                       3
                                n
heap
               repeat
                                     (symbol,n) => ...
definitions
                draw_line
                                         (n) => ...
                draw_empty_square
                                         (n) => ...
globals
                                     null
                                ret
                                       3
                                n
stack
                                     null
                                ret
                                       3
                                n
heap
                                     (symbol,n) => ...
                repeat
definitions
                draw_line
                                         (n) \Rightarrow \dots
                draw_empty_square
                                         (n) => ...
```

```
globals
                                 ret
                                       "***"
                                 n
                                          3
stack
                                  ret
                                        null
                                          3
                                  n
heap
                                       (symbol,n) \Rightarrow \dots
                repeat
definitions
                draw_line
                                            (n) => ...
                draw_empty_square
                                           (n) \Rightarrow \dots
globals
                                  ret
                                        null
stack
                                          3
                                  n
heap
                                       (symbol,n) => \dots
                repeat
                draw_line
                                           (n) => ...
definitions
                 draw_empty_square
                                           (n) => ...
globals
                                ret
                                        null
stack
                                n
                                          3
                                1
                                      "***\n"
heap
                repeat
                                       (symbol,n) \Rightarrow \dots
                                            (n) => ...
                draw_line
definitions
                draw_empty_square
                                            (n) => ...
globals
                                ret
                                         null
                                symbol
                                           1
stack
                                ret
                                        null
                                          3
                                n
                                1
                                      "***\n"
heap
                                       (symbol,n) \Rightarrow \dots
                repeat
definitions
                draw_line
                                            (n) => ...
                 draw_empty_square
                                           (n) \Rightarrow \dots
```

```
globals
                                 ret
                                          null
                                 symbol
                                            1
stack
                                 res
                                 ret
                                        null
                                          3
                                 n
                                 1
                                       "***\n"
heap
                                        (symbol,n) => ...
                 repeat
definitions
                 draw_line
                                             (n) \Rightarrow \dots
                 draw_empty_square
                                            (n) => ...
globals
                                          null
                                 symbol
                                            1
stack
                                 res
                                 ret
                                        null
                                 n
                                          3
                                       "***\n"
heap
                                        (symbol,n) \Rightarrow \dots
                 repeat
definitions
                 draw_line
                                             (n) \Rightarrow \dots
                                             (n) => ...
                 draw_empty_square
globals
                                 ret
                                          null
                                 symbol
                                            1
                                           11 11
stack
                                 res
                                 ret
                                        null
                                          3
                                 n
                                       "***\n"
heap
                                        (symbol,n) \Rightarrow \dots
                 repeat
                                             (n) \Rightarrow \dots
definitions
                 draw_line
                 draw_empty_square
                                             (n) => ...
```

```
globals
                                 ret
                                           null
                                 symbol
                                           11 11
stack
                                 res
                                 ret
                                         null
                                           3
                                 n
                                 1
                                       "***\n"
heap
                                        (symbol,n) => ...
                 repeat
definitions
                 draw_line
                                             (n) \Rightarrow \dots
                 draw_empty_square
                                             (n) => ...
globals
                                 ret
                                           null
                                 symbol
                                            0
                                           11 11
stack
                                 res
                                 ret
                                         null
                                 n
                                           3
                                       "***\n"
heap
                                        (symbol,n) \Rightarrow \dots
                 repeat
definitions
                 draw_line
                                             (n) \Rightarrow \dots
                 draw_empty_square
                                             (n) => ...
globals
                                  ret
                                  symbol
                                             0
                                           11 11
stack
                                  res
                                 ret
                                         null
                                           3
                                 n
                                       "***\n"
heap
                                         (symbol,n) \Rightarrow \dots
                 repeat
                 draw_line
                                             (n) \Rightarrow \dots
definitions
                 draw_empty_square
                                             (n) => ...
```

```
globals
                                         null
                                 ret
stack
                                 n
                                           3
                                        "***\n"
heap
                                         (symbol,n) \Rightarrow \dots
                 repeat
                 draw_line
                                             (n) \Rightarrow \dots
definitions
                 draw_empty_square
                                             (n) \Rightarrow \dots
globals
                             ret
                                              null
                                               3
                             n
stack
                                            "***\n"
                             1
                                            "* *\n"
                             empty_line
heap
                 repeat
                                         (symbol,n) => ...
definitions
                 draw_line
                                             (n) \Rightarrow \dots
                 draw_empty_square
                                             (n) => ...
globals
                               ret
                                           null
                                         "* *\n"
                               symbol
stack
                                             null
                             ret
                                               3
                             n
                                            "***\n"
                             1
                             empty_line
                                            "* *\n"
heap
                 repeat
                                         (symbol,n) \Rightarrow \dots
                 draw_line
                                             (n) \Rightarrow \dots
definitions
                 draw_empty_square
                                             (n) => ...
```

```
globals
                              ret
                                         null
                              symbol
                                        "* *\n"
                                           1
                                           11 11
                              res
stack
                            ret
                                            null
                                              3
                            n
                                          "***\n"
                            1
                            empty_line
                                          "* *\n"
heap
                repeat
                                        (symbol,n) => \dots
definitions
                 draw_line
                                            (n) => ...
                 draw_empty_square
                                            (n) \Rightarrow \dots
globals
                              ret
                                          null
                                        "* *\n"
                              symbol
                              n
                                           1
                                           11 11
                              res
stack
                            ret
                                            null
                            n
                                              3
                                          "***\n"
                            1
                            empty_line
                                          "* *\n"
heap
                repeat
                                       (symbol,n) \Rightarrow \dots
definitions
                                            (n) => ...
                 draw_line
                 draw_empty_square
                                            (n) \Rightarrow \dots
```

```
globals
                               ret
                                          null
                               symbol
                                        "* *\n"
                                            1
                                        "* *\n"
                               res
stack
                                            null
                            ret
                                              3
                            n
                                           "***\n"
                            1
                            empty_line
                                           "* *\n"
heap
                 repeat
                                        (symbol,n) => \dots
definitions
                 draw_line
                                            (n) \Rightarrow \dots
                 draw_empty_square
                                            (n) \Rightarrow \dots
globals
                               ret
                                          null
                                        "* *\n"
                               symbol
                              n
                                            0
                                        "* *\n"
                               res
stack
                            ret
                                            null
                                              3
                            n
                                           "***\n"
                            1
                            empty_line
                                           "* *\n"
heap
                 repeat
                                        (symbol,n) \Rightarrow \dots
                                            (n) => ...
definitions
                 draw_line
                 draw_empty_square
                                            (n) \Rightarrow \dots
```

```
globals
                                       null
                            ret
                            symbol
                                     "* *\n"
                                     "* *\n"
                            res
stack
                          ret
                                         null
                                           3
                          n
                                        "***\n"
                          1
                                        "* *\n"
                          empty_line
heap
                                     (symbol,n) => \dots
               repeat
definitions
               draw_line
                                         (n) =>
               draw_empty_square
                                         (n) =>
globals
                            ret
                                     "* *\n"
                            symbol
                                     "* *\n"
                            n
                                        0
                                     "* *\n"
                            res
stack
                          ret
                                         null
                          n
                                           3
                                        "***\n"
                          1
                          empty_line
                                        "* *\n"
heap
                                     (symbol,n) => ...
               repeat
definitions
               draw_line
                                         (n) =>
               draw_empty_square
                                         (n) \Rightarrow \dots
globals
                                         null
                          ret
                                           3
                          n
stack
                                        "***\n"
                                        "* *\n"
                          empty_line
heap
               repeat
                                     (symbol,n) =>
definitions
               draw_line
                                         (n) => ...
               draw_empty_square
                                         (n) => ...
```

```
globals
                                  "***\n* *\n***\n"
                    ret
                                           3
                    n
stack
                                        "***\n"
                    1
                                        "* *\n"
                     empty_line
heap
               repeat
                                     (symbol,n) => \dots
definitions
               draw_line
                                         (n) \Rightarrow \dots
                                         (n) => ...
               draw_empty_square
globals
stack
heap
                                     (symbol,n) => \dots
               repeat
definitions
                                         (n) => ...
               draw_line
               draw_empty_square
                                         (n) \Rightarrow \dots
                             "***\n* *\n***\n"
globals
stack
heap
                                     (symbol,n) => \dots
               repeat
definitions
               draw_line
                                         (n) => ...
               draw_empty_square
                                         (n) => ...
                             "***\n* *\n***\n"
globals
stack
heap
                                     (symbol,n) => \dots
               repeat
definitions
               draw_line
                                         (n) => ...
                                         (n) => ...
               draw_empty_square
                          "***\n* *\n***\n"
output
```

Lecture Homework 3 - Triangles

Draw triangle Fill in the missing code blocks

```
def repeat (symbol,n):
1
     res=""
2
3
     while ((n>0)):
       res=(res+symbol)
4
5
       n=(n-1)
6
     return res
7
   def draw_line (n):
8
     return repeat("*",n)
9
10
   def draw_triangle (n):
11
     if((n<=0)):
12
13
       return
14
     else:
                                     )+("\n"+draw_triangle((
15
       return (draw_line(
                             ))))
16
17 | res=draw_triangle(
                                 )
   print (res)
```

```
globals
stack
heap
definitions
globals
stack
heap
{\tt definitions}
                repeat
                         (symbol,n) => \dots
globals
stack
heap
                repeat
                             (symbol,n) => \dots
definitions
                draw_line
                                 (n) \Rightarrow \dots
globals
stack
heap
                                 (symbol,n) => \dots
                repeat
definitions
                draw_line
                                     (n) => ...
                draw_triangle
                                     (n) => ...
```



globals				
stack		ret	null	
	_	n	3	
heap				
	repeat	(:	symbol,n)	=>
definitions	draw_line		(n) =>	
	draw_trian	ngle	(n) =>	• • •
globals				
stack		ret	null	
2 0 4 0 11	_	n	3	
heap				
	repeat	(:	symbol,n)	
definitions	draw_line		(n) =>	
_	draw_trian	ngle	(n) =>	
globals				
		ret	null	
stack	_	n	3	
BUCK		ret	null	
	_	n	3	
heap				
	repeat	(:	symbol,n)	=>
definitions	draw_line		(n) =>	
	draw_trian	ngle	(n) =>	
globals				
		ret	null	
		symbol	L "*"	
		n	3	
stack		ret	null	
		n	3	
		ret	null	
		n	3	
heap				
	repeat	()	symbol,n)	=>
definitions	draw_line		(n) =>	
	draw_trian	ngle	(n) =>	

```
globals
                           ret
                                   null
                           symbol
                                    "*"
                                     3
                           res
stack
                            ret null
                                   3
                            ret
                                  null
                                   3
                            n
heap
                               (symbol,n) => ...
               repeat
definitions
               draw_line
                                   (n) => ...
                                   (n) =>
               draw_triangle
globals
                           ret
                                   null
                                    "*"
                           symbol
                                     3
                           n
                                    11 11
                           res
stack
                            ret
                                  null
                                   3
                            n
                                  null
                            ret
                                   3
                            n
heap
                               (symbol,n) => ...
               repeat
                                   (n) => ...
definitions
               draw_line
               draw_triangle
                                   (n) => ...
```

```
globals
                          ret
                                   null
                          symbol
                                   "*"
                                    3
                                   "*"
                          res
stack
                            ret null
                                   3
                            ret
                                 null
                                   3
                            n
heap
                               (symbol,n) => ...
              repeat
                                  (n) => ...
definitions
              draw_line
               draw_triangle
                                   (n) =>
globals
                          ret
                                   null
                                   "*"
                          symbol
                                    2
                          n
                                   "*"
                          res
stack
                            ret
                                 null
                                   3
                            n
                            ret
                                 null
                                   3
                            n
heap
                               (symbol,n) => ...
              repeat
                                  (n) => ...
definitions
              draw_line
               draw_triangle
                                  (n) => ...
```

globals				
		ret	null	
		symbol	1 "*"	
		n	2	
		res	"*"	
stack		ret	null	
		n	3	
		ret	null	
		n	3	
heap				
	repeat	(;	symbol,n)	=>
definitions	draw_line		(n) =>	
	draw_trian	gle	(n) =>	
globals				
		ret	null	
		symbol	1 "*"	
		n	2	
a+ a a lt		res	"**"	
stack		ret	null	
		n	3	
		ret	null	
		n	3	
heap				
definitions	repeat	(:	symbol,n)	=>
	draw_line		(n) =>	
	draw_trian	gle	(n) =>	

```
globals
                          ret
                                   null
                          symbol
                                   "*"
                                    1
                                   "**"
                          res
stack
                            ret null
                                   3
                            ret
                                 null
                                   3
                            n
heap
                              (symbol,n) => ...
              repeat
definitions
              draw_line
                                  (n) => ...
                                  (n) => ...
               draw_triangle
globals
                          ret
                                   null
                                   "*"
                          symbol
                                    1
                          n
                                   "**"
                          res
stack
                            ret
                                null
                                   3
                            n
                                 null
                            ret
                                   3
                            n
heap
                              (symbol,n) => ...
              repeat
                                  (n) => ...
definitions
              draw_line
               draw_triangle
                                  (n) => ...
```

```
globals
                          ret
                                  null
                          symbol
                                   "*"
                                    1
                                  "***"
                          res
stack
                            ret null
                                   3
                            n
                            ret
                                 null
                                   3
                            n
heap
                              (symbol,n) => ...
              repeat
definitions
              draw_line
                                  (n) => ...
              draw_triangle
                                  (n) => ...
globals
                          ret
                                  null
                                   "*"
                          symbol
                                    0
                          n
                                  "***"
                          res
stack
                            ret
                                null
                                   3
                            n
                                 null
                            ret
                                  3
                            n
heap
                              (symbol,n) => ...
              repeat
                                  (n) => ...
definitions
              draw_line
              draw_triangle
                                  (n) => ...
```

```
globals
                           ret
                                     null
                           symbol
                                     "*"
                           n
                           res
                                    "***"
{\tt stack}
                             ret null
                                     3
                             n
                             ret
                                   null
                             n
heap
                                (symbol,n) => \dots
               repeat
definitions
               draw_line
                                    (n) =>
               draw_triangle
                                    (n) =>
globals
                           ret
                                    "***"
                           symbol
                                     "*"
                           n
                                      0
                                    "***"
                           res
stack
                             ret
                                   null
                                     3
                             n
                                   null
                             ret
                                     3
                             n
heap
               repeat
                                (symbol,n) => ...
               draw_line
definitions
                                    (n) => ...
               draw_triangle
                                    (n) => ...
globals
                                   null
                             ret
                                     3
                             n
stack
                                   null
                             ret
                                     3
heap
                                (symbol,n) \Rightarrow \dots
               repeat
definitions
                                    (n) => ...
               draw_line
               draw_triangle
                                    (n) => ...
```

```
globals
                           ret
                                "***"
                                  3
stack
                           ret
                                null
                                  3
                           n
heap
                              (symbol,n) => ...
              repeat
definitions
              draw_line
                                 (n) => ...
              draw_triangle
                                 (n) => ...
globals
                           ret null
stack
                                  3
                           n
heap
                              (symbol,n) => \dots
              repeat
              draw_line
                                 (n) => ...
definitions
                                 (n) => ...
              draw_triangle
globals
                           ret null
                           n
                                  2
stack
                           ret null
                           n
heap
                             (symbol,n) => ...
              repeat
definitions
              draw_line
                                 (n) => ...
              draw_triangle
                                 (n) => ...
globals
                           ret null
                           n
stack
                           ret null
                                  3
                           n
heap
              repeat
                              (symbol,n) => \dots
              draw_line
definitions
                                 (n) => ...
              draw_triangle
                                 (n) => ...
```

globals		
	r	cet null
	n	n 2
	r	cet null
stack	n	n 2
	r	cet null
	n	n 3
heap		
	repeat	(symbol,n) =>
definitions	draw_line	(n) =>
	draw_triangle	(n) =>
globals		
	ret	t null
	syr	mbol "*"
	n	2
	r	ret null
stack	n	n 2
	r	cet null
	n	n 2
	r	ret null
	n	n 3
heap		
	repeat	(symbol,n) =>
definitions	draw_line	(n) =>
	draw_triangle	(n) =>

```
globals
                           ret
                                    null
                           symbol
                                     "*"
                                      2
                           res
                             ret null
stack
                                    2
                             ret
                                  null
                                    2
                             n
                                  null
                             ret
                                    3
                             n
heap
                                (symbol,n) => ...
               repeat
               draw_line
                                    (n) => ...
definitions
               draw_triangle
                                    (n) => ...
globals
                           ret
                                    null
                                     "*"
                           symbol
                           n
                                      2
                           res
                                  null
                             ret
stack
                                    2
                             n
                                  null
                             ret
                                    2
                                  null
                             ret
                                    3
heap
                                (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) => ...
```

```
globals
                           ret
                                    null
                           symbol
                                     "*"
                                      2
                                     "*"
                           res
                             ret null
stack
                                    2
                             ret
                                  null
                                    2
                             n
                                  null
                             ret
                                    3
                             n
heap
                                (symbol,n) => ...
               repeat
               draw_line
                                    (n) => ...
definitions
               draw_triangle
                                   (n) => ...
globals
                           ret
                                    null
                                     "*"
                           symbol
                           n
                                      1
                           res
                                  null
                             ret
stack
                                    2
                             n
                                  null
                             ret
                                    2
                                  null
                             ret
                                    3
heap
                                (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) => ...
```

```
globals
                           ret
                                    null
                           symbol
                                     "*"
                                      1
                                     "*"
                           res
                             ret null
stack
                                    2
                             ret
                                  null
                                    2
                             n
                                  null
                             ret
                                    3
                             n
heap
                                (symbol,n) => ...
               repeat
               draw_line
                                    (n) => ...
definitions
               draw_triangle
                                   (n) => ...
globals
                           ret
                                    null
                                     "*"
                           symbol
                           n
                                      1
                           res
                                    "**"
                                  null
                             ret
stack
                                    2
                             n
                                  null
                             ret
                                    2
                                  null
                             ret
                                    3
heap
                                (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) => ...
```

```
globals
                           ret
                                    null
                           symbol
                                    "*"
                                     0
                                    "**"
                           res
                            ret null
stack
                                    2
                            ret
                                  null
                                    2
                             n
                                  null
                             ret
                                    3
                             n
heap
                               (symbol,n) => ...
               repeat
               draw_line
                                   (n) => ...
definitions
               draw_triangle
                                   (n) => ...
globals
                           ret
                                    null
                                    "*"
                           symbol
                           n
                                     0
                           res
                                    "**"
                                  null
                            ret
stack
                                    2
                            n
                                  null
                            ret
                                    2
                                  null
                            ret
                                    3
heap
                               (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_line
                                   (n) => ...
               draw_triangle
                                   (n) => ...
```

globals				
		ret	"**"	
		symbol	l "*"	
		n	0	
		res	"**"	_
		ret	null	
stack		n	2	_
		ret	null	
		n	2	
		ret	null	
		n	3	
heap				_
	repeat	(:	symbol,n) =>
definitions	draw_line		(n) =>	·
	draw_trian	gle	(n) =>	·
globals				
		ret	null	
		n	2	
stack		ret	null	
		n	2	
		ret	null	
		n	3	
heap				
	repeat	(:	symbol,n) =>
definitions	draw_line		(n) =>	·
	draw_trian	gle	(n) =>	·

```
globals
                                     "**"
                               ret
                               n
                                       2
                               ret
                                     null
stack
                                       2
                               n
                                     null
                               ret
                                       3
                               n
heap
                                  (symbol,n) \Rightarrow \dots
                repeat
definitions
                draw_line
                                       (n) => ...
                draw_triangle
                                      (n) => ...
globals
                               ret null
                               n
stack
                               ret null
                                       3
                               n
heap
                repeat
                                  (symbol,n) => \dots
definitions
                draw_line
                                       (n) => ...
                draw_triangle
                                       (n) \Rightarrow \dots
globals
                               ret null
                               n
                                       1
                               ret
                                     null
{\tt stack}
                                       2
                               n
                                     null
                               ret
                                       3
                               n
heap
                                  (symbol,n) => ...
                repeat
definitions
                draw_line
                                       (n) \Rightarrow \dots
                draw_triangle
                                       (n) \Rightarrow \dots
```

```
globals
                           ret null
                           n
                                 1
                                null
                           ret
stack
                                  2
                           n
                               null
                           ret
                                  3
                           n
heap
                             (symbol,n) => ...
              repeat
              draw_line
                                 (n) => ...
definitions
              draw_triangle
                                 (n) => ...
globals
                           ret null
                           n
                              1
                           ret null
                                 1
                           n
stack
                           ret null
                                  2
                           n
                           ret null
                                  3
{\tt heap}
                             (symbol,n) => ...
              repeat
definitions
              draw_line
                                 (n) => ...
              draw_triangle
                                 (n) => ...
```

```
globals
                            ret
                                     null
                            symbol
                                      "*"
                              ret null
                                     1
                              n
{\tt stack}
                              ret
                                   null
                              n
                                     1
                                   null
                              ret
                                     2
                                   null
                              ret
                                     3
                              n
heap
               repeat
                                 (symbol,n) \Rightarrow \dots
               draw_line
                                     (n) =>
definitions
                                     (n) => ...
                draw_triangle
globals
                            ret
                                     null
                                      "*"
                            symbol
                                       1
                            n
                                      11 11
                            res
                              ret null
                              n
                                     1
stack
                              ret
                                   null
                                     1
                              n
                                   null
                              ret
                                     2
                                   null
                              ret
                                     3
                              n
heap
                                 (symbol,n) => ...
               repeat
               draw_line
                                     (n) =>
definitions
               draw_triangle
                                     (n) => ...
```

```
globals
                           ret
                                    null
                           symbol
                                     "*"
                                      1
                           res
                             ret null
stack
                             ret
                                  null
                                    1
                                  null
                             ret
                                    2
                             n
                                  null
                             ret
                                    3
                             n
heap
                                (symbol,n) => ...
               repeat
definitions
                                    (n) => ...
               draw_line
               draw_triangle
                                    (n) => ...
globals
                           ret
                                    null
                           symbol
                                     "*"
                                      1
                                     "*"
                           res
                             ret
                                  null
{\tt stack}
                                  null
                             ret
                             n
                                  null
                             ret
                             n
                             ret
                                  null
                                    3
                             n
heap
               repeat
                                (symbol,n) => \dots
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) => ...
```

```
globals
                           ret
                                    null
                            symbol
                                     "*"
                                      0
                                     "*"
                           res
                             ret null
stack
                             ret
                                   null
                                    1
                                   null
                             ret
                                     2
                             n
                                   null
                             ret
                                    3
                             n
heap
                                (symbol,n) => ...
               repeat
definitions
                                    (n) => ...
               draw_line
               draw_triangle
                                    (n) => ...
globals
                           ret
                                    null
                            symbol
                                     "*"
                                      0
                                     "*"
                           res
                             ret
                                   null
                                     1
{\tt stack}
                                   null
                             ret
                             n
                                   null
                             ret
                             n
                             ret
                                   null
                                    3
                             n
heap
               repeat
                                (symbol,n) => \dots
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) => ...
```

```
globals
                                    "*"
                           ret
                           symbol
                                    0
                                    "*"
                           res
                            ret null
                                   1
stack
                            ret
                                 null
                                   1
                            n
                                 null
                            ret
                                   2
                            n
                                 null
                            ret
                                   3
                            n
heap
                               (symbol,n) => ...
               repeat
definitions
               draw_line
                                   (n) => ...
               draw_triangle
                                  (n) => ...
globals
                            ret null
                                   1
                                 null
                            ret
                                   1
stack
                            ret
                                 null
                            n
                                 null
                            ret
                                   3
                            n
heap
                               (symbol,n) => \dots
               repeat
definitions
               draw_line
                                   (n) => ...
               draw_triangle
                                   (n) => ...
```

globals						
		ret	"*"			
		n	1	_		
		ret	null			
-+1-		n	1	_		
stack		ret	null			
		n	2	_		
		ret	null			
		n	3	_		
heap						
	repeat	(s	symbol,	n)	=>	
definitions	draw_line		(n)	=>		
	draw_trian@	gle	(n)	=>		
globals						
		ret	null			
		n	1	_		
stack		ret	null			
Stack		n	2	_		
		ret	null			
		n	3	_		
heap						
definitions	repeat	(s	symbol,	n)	=>	
	draw_line		(n)	=>		
	draw_triang	gle	(n)	=>		

globals						
		ret	null			
		n	0			
		ret	null			
. 1		n	1			
stack		ret	null			
		n	2			
		ret	null			
		n	3			
heap						
	repeat	(:	symbol	,n)	=>	
definitions	draw_line		(n)	=>		
	draw_triang	gle	(n)	=>		
globals						
		ret	null			
		n	0			
		ret	null			
stack		n	1			
Stack		ret	null			
		n	2			
		ret	null			
		n	3			
heap				_		
definitions	repeat	(:	symbol	,n)	=>	
	draw_line		(n)	=>		
	draw_triang	gle	(n)	=>		

```
globals
                                     11 11
                                ret
                                n
                                      0
                               ret
                                     null
                                       1
{\tt stack}
                               ret
                                    null
                                       2
                               n
                                     null
                               ret
                                       3
                               n
heap
                                  (symbol,n) => \dots
                repeat
                draw_line
                                      (n) => ...
definitions
                draw_triangle
                                      (n) => ...
globals
                               ret null
                                      1
                               n
                                    null
                               ret
stack
                               n
                                     null
                               ret
                                       3
heap
                                  (symbol,n) => ...
                repeat
                                      (n) => ...
definitions
                draw_line
                draw_triangle
                                      (n) \Rightarrow \dots
globals
                              ret "*\n"
                                      1
                               ret
                                     null
{\tt stack}
                               n
                                    null
                               ret
                               n
heap
                                  (symbol,n) \Rightarrow \dots
                repeat
definitions
                draw_line
                                      (n) \Rightarrow \dots
                draw_triangle
                                      (n) => ...
```

```
globals
                             ret null
                                    2
                             n
stack
                             ret
                                  null
                                    3
                             n
heap
                                (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) => ...
globals
                                "**\n*\n"
                          ret
                                    2
stack
                             ret null
                             n
heap
                                (symbol,n) => \dots
               repeat
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) => ...
globals
                             ret null
stack
heap
                               (symbol,n) => ...
               repeat
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) => ...
globals
                       ret "***\n**\n"
stack
heap
               repeat
                                (symbol,n) \Rightarrow \dots
definitions
               draw_line
                                    (n) => ...
               draw_triangle
                                    (n) \Rightarrow \dots
```

```
globals
{\tt stack}
heap
               repeat
                                (symbol,n) => \dots
                                    (n) => ...
definitions
               draw_line
               draw_triangle
                                    (n) => ...
                           "***\n**\n*\n"
                      res
globals
stack
heap
                                (symbol,n) => \dots
               repeat
               draw_line
                                    (n) => ...
definitions
               draw_triangle
                                   (n) \Rightarrow \dots
globals
                      res
                            "***\n**\n*\n"
{\tt stack}
heap
                                (symbol,n) => \dots
               repeat
definitions
               draw_line
                                   (n) => ...
               draw_triangle
                                   (n) => ...
                         "***\n**\n*\n"
output
```

Draw pyramid Fill in the missing state blocks

```
def repeat (symbol,n):
1
     res=""
2
3
     while ((n>0)):
4
       res=(res+symbol)
5
       n=(n-1)
6
     return res
7
   def draw_pyramid_AUX (num_spaces,num_stars):
8
9
     if((num_spaces<0)):</pre>
10
       return ""
11
     else:
12
       spaces=repeat(" ",num_spaces)
13
       stars=repeat("*", num_stars)
14
       return (spaces+(stars+("\n"+draw_pyramid_AUX((num_spaces
           -1),(num_stars+2)))))
15
16
   def draw_pyramid (n):
17
     return draw_pyramid_AUX((n-1),1)
18
19
  res=draw_pyramid(3)
20
  print (res)
```

```
globals
stack
heap
definitions
globals
stack
heap
definitions
                       (symbol,n) => \dots
              repeat
globals
stack
heap
               repeat
                                         (symbol,n) => \dots
definitions
                                  (num_spaces,num_stars) => ...
               draw_pyramid_AUX
globals
stack
heap
              repeat
                                         (symbol,n) => ...
                                  (num_spaces,num_stars) => ...
definitions
              draw_pyramid_AUX
                                            (n) => ...
               draw_pyramid
```

```
globals
                                         null
                                  ret
stack
                                 n
heap
                                        (symbol,n) => \dots
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                           (n) => ...
globals
                                ret
                                             null
                                num_spaces
                                num_stars
stack
                                    ret null
                                    n
                                           3
heap
                                        (symbol,n) => \dots
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
globals
                                ret
                                             null
                                num_spaces
                                              2
                                num_stars
stack
                                    ret null
                                           3
                                    n
heap
                                        (symbol,n) \Rightarrow \dots
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
                                            (n) => ...
              draw_pyramid
```

```
globals
                                  ret
                                          null
                                  symbol
                                ret
                                             null
stack
                                num_spaces
                                              2
                                num_stars
                                 ret
                                         null
                                 n
heap
                                        (symbol,n) => \dots
              repeat
              draw_pyramid_AUX
                                 (num_spaces,num_stars) => ...
definitions
                                           (n) => ...
              draw_pyramid
globals
                                  ret
                                          null
                                  symbol
                                            2
                                  n
                                            11 11
                                  res
stack
                                ret
                                             null
                                num_spaces
                                              2
                                num_stars
                                    ret null
                                           3
                                    n
heap
                                        (symbol,n) => ...
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                           (n) => ...
```

```
globals
                                  ret
                                          null
                                  symbol
                                           11 11
                                  res
stack
                                ret
                                            null
                                              2
                                num_spaces
                                num_stars
                                   ret null
                                          3
heap
              repeat
                                        (symbol,n) => \dots
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
globals
                                  ret
                                          null
                                  symbol
                                  res
stack
                                ret
                                            null
                                num_spaces
                                              2
                                num_stars
                                   ret null
                                          3
heap
              repeat
                                        (symbol,n) => \dots
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                           (n) => ...
```

```
globals
                                  ret
                                           null
                                  symbol
                                            1
                                           11 11
                                  res
stack
                                ret
                                            null
                                num_spaces
                                              2
                                num_stars
                                    ret null
                                           3
heap
              repeat
                                        (symbol,n) => \dots
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                            (n) => ...
globals
                                  ret
                                          null
                                  symbol
                                            1
                                  res
stack
                                ret
                                            null
                                num_spaces
                                              2
                                num_stars
                                    ret null
                                           3
heap
              repeat
                                        (symbol,n) => \dots
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                           (n) \Rightarrow \dots
```

```
globals
                                  ret
                                          null
                                  symbol
                                           1
                                          11 11
                                  res
stack
                                ret
                                           null
                                num_spaces
                                              2
                                num_stars
                                   ret null
                                          3
heap
              repeat
                                        (symbol,n) => \dots
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
globals
                                  ret
                                          null
                                  symbol
                                  res
stack
                                ret
                                            null
                                num_spaces
                                             2
                                num_stars
                                   ret null
                                          3
heap
              repeat
                                        (symbol,n) => \dots
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                           (n) \Rightarrow \dots
```

```
globals
                                  ret
                                          null
                                  symbol
                                  res
stack
                                ret
                                            null
                                              2
                                num_spaces
                                num_stars
                                    ret null
                                          3
heap
              repeat
                                        (symbol,n) => \dots
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                            (n) => ...
globals
                                  ret
                                  symbol
                                  res
stack
                                ret
                                             null
                                num_spaces
                                              2
                                num_stars
                                              1
                                 ret
                                          3
                                 n
heap
              repeat
                                        (symbol,n) => \dots
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                           (n) => ...
```

```
globals
                                 ret
                                               null
                                 num_spaces
stack
                                  num_stars
                                     ret null
                                             3
                                     n
heap
               repeat
                                          (symbol,n) \Rightarrow \dots
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                              (n) => ...
globals
                                 ret
                                               null
                                  num_spaces
                                                2
                                  num_stars
stack
                                  spaces
                                     ret null
                                             3
heap
               repeat
                                          (symbol,n) \Rightarrow \dots
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
globals
                                    ret
                                            null
                                             "*"
                                    symbol
                                              1
                                               null
                                 ret
                                                2
stack
                                  num_spaces
                                  num_stars
                                  spaces
                                     ret null
                                             3
heap
               repeat
                                          (symbol,n) \Rightarrow \dots
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) => ...
```

```
globals
                                     ret
                                              null
                                     symbol
                                              "*"
                                     n
                                               1
                                               11 11
                                     res
                                  ret
                                                null
stack
                                                  2
                                  num_spaces
                                  num_stars
                                                  1
                                  spaces
                                      ret null
                                              3
heap
                                           (symbol,n) \Rightarrow \dots
               repeat
                                    (num_spaces,num_stars) => ...
               draw_pyramid_AUX
definitions
                draw_pyramid
                                               (n) => ...
globals
                                     ret
                                              null
                                              "*"
                                     symbol
                                     n
                                               1
                                     res
                                                null
stack
                                  num_spaces
                                                  2
                                  num_stars
                                  spaces
                                      ret null
                                              3
heap
                                           (symbol,n) \Rightarrow \dots
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                             (n) \Rightarrow \dots
```

```
globals
                                   ret
                                            null
                                   symbol
                                             "*"
                                              1
                                             "*"
                                   res
                                 ret
                                              null
stack
                                                2
                                 num_spaces
                                 num_stars
                                                1
                                 spaces
                                     ret null
                                            3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                             (n) => ...
globals
                                   ret
                                            null
                                            "*"
                                   symbol
                                   n
                                              0
                                   res
                                              null
stack
                                 num_spaces
                                                2
                                 num_stars
                                 spaces
                                     ret null
                                            3
heap
                                          (symbol,n) => ...
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                            (n) \Rightarrow \dots
```

```
globals
                                    ret
                                             null
                                    symbol
                                             "*"
                                              0
                                             "*"
                                    res
                                  ret
                                               null
stack
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                      ret null
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
                                   (num_spaces,num_stars) => ...
               draw_pyramid_AUX
definitions
               draw_pyramid
                                              (n) => ...
globals
                                             "*"
                                    ret
                                             "*"
                                    symbol
                                    n
                                              0
                                    res
                                  ret
                                               null
stack
                                  num_spaces
                                                 2
                                  num_stars
                                  spaces
                                   ret
                                             3
                                   n
heap
                                          (symbol,n) => ...
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                             (n) \Rightarrow \dots
```

```
globals
                               ret
                                          null
                               num_spaces
                                           2
                               num_stars
stack
                               spaces
                                  ret null
                                         3
                                  n
heap
                                      (symbol,n) => ...
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                          (n) => ...
globals
                              ret
                                           null
                               num_spaces
                                            2
                               num_stars
                                           1
                               spaces
stack
                               stars
                                  ret null
                                         3
heap
                                      (symbol,n) => ...
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
                                         (n) => ...
              draw_pyramid
```

```
globals
                                            null
                               ret
                               num_spaces
                                             1
                               num_stars
                               ret
                                            null
                               num_spaces
                                             2
stack
                               num_stars
                                             1
                               spaces
                               stars
                                   ret null
                                          3
heap
                                       (symbol,n) => \dots
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                          (n) => ...
globals
                               ret
                                            null
                               num_spaces
                               num_stars
                                            3
                                            null
                               ret
                               num_spaces
                                            2
stack
                               num_stars
                                             1
                               spaces
                               stars
                                   ret null
                                          3
heap
                                       (symbol,n) => \dots
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
                                         (n) => ...
              draw_pyramid
```

```
globals
                                 ret
                                         null
                                 symbol
                               ret
                                           null
                               num_spaces
                                             1
                               num_stars
                                            3
stack
                               ret
                                            null
                               num_spaces
                                             2
                               num_stars
                                            1
                               spaces
                                            "*"
                               stars
                                   ret null
                                          3
heap
                                       (symbol,n) => \dots
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                           (n) \Rightarrow \dots
```

```
globals
                                   ret
                                           null
                                   symbol
                                             1
                                             11 11
                                   res
                                 ret
                                             null
                                               1
                                 num_spaces
                                 num_stars
stack
                                 ret
                                              null
                                               2
                                 num_spaces
                                 num_stars
                                 spaces
                                 stars
                                    ret null
                                            3
                                    n
heap
                                         (symbol,n) \Rightarrow \dots
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                             (n) => ...
```

```
globals
                                  ret
                                           null
                                  symbol
                                            1
                                            11 11
                                  res
                                ret
                                            null
                                             1
                                num_spaces
                                num_stars
                                               3
stack
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                spaces
                                stars
                                    ret null
                                           3
                                    n
heap
                                        (symbol,n) \Rightarrow \dots
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                            (n) => ...
```

```
globals
                                  ret
                                          null
                                  symbol
                                           1
                                           11 11
                                  res
                                ret
                                            null
                                            1
                                num_spaces
                                num_stars
stack
                                ret
                                            null
                                             2
                                num_spaces
                                num_stars
                                spaces
                                stars
                                   ret null
                                          3
                                   n
heap
                                        (symbol,n) \Rightarrow \dots
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
```

```
globals
                                  ret
                                           null
                                  symbol
                                            0
                                           11 11
                                  res
                                ret
                                            null
                                             1
                                num_spaces
                                num_stars
                                              3
stack
                                ret
                                             null
                                              2
                                num_spaces
                                num_stars
                                spaces
                                stars
                                    ret null
                                           3
                                    n
heap
                                        (symbol,n) \Rightarrow \dots
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                            (n) => ...
```

```
globals
                                  ret
                                          null
                                  symbol
                                            0
                                           11 11
                                  res
                                ret
                                            null
                                            1
                                num_spaces
                                num_stars
stack
                                ret
                                             null
                                             2
                                num_spaces
                                num_stars
                                spaces
                                stars
                                   ret null
                                           3
                                   n
heap
                                        (symbol,n) \Rightarrow \dots
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                            (n) => ...
```

```
globals
                                      ret
                                      symbol
                                      res
                                   ret
                                                null
                                                  1
                                   num_spaces
                                   num_stars
                                                  3
stack
                                   ret
                                                null
                                   num_spaces
                                                  2
                                   num_stars
                                   spaces
                                                 "*"
                                   stars
                                    ret
                                              3
                                    n
heap
                                           (symbol,n) \Rightarrow \dots
                repeat
                draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
                draw_pyramid
                                                (n) \Rightarrow \dots
globals
                                   ret
                                                null
                                   num_spaces
                                                  1
                                   num_stars
                                                  3
                                                 null
                                   ret
                                   num_spaces
                                                  2
stack
                                   num_stars
                                                  1
                                   spaces
                                   stars
                                       ret null
                                              3
                                       n
heap
                                            (symbol,n) => \dots
                repeat
definitions
                draw_pyramid_AUX (num_spaces,num_stars) => ...
                draw_pyramid
                                                (n) \Rightarrow \dots
```

```
globals
                                  ret
                                               null
                                  num_spaces
                                                 1
                                  num_stars
                                                 3
                                                11 11
                                  spaces
                                  ret
                                               null
                                                 2
stack
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                           null
                                     ret
                                             3
heap
                                          (symbol,n) => \dots
               repeat
definitions
               draw_pyramid_AUX
                                   (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) \Rightarrow \dots
globals
                                             null
                                    ret
                                              "*"
                                    symbol
                                    n
                                               null
                                  ret
                                                 1
                                  num_spaces
                                  num_stars
                                                 3
                                                11 11
                                  spaces
stack
                                  ret
                                               null
                                  num_spaces
                                                 2
                                  num_stars
                                                 1
                                  spaces
                                                "*"
                                  stars
                                   ret
heap
                                          (symbol,n) => \dots
               repeat
definitions
               draw_pyramid_AUX
                                   (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                  ret
                                           null
                                  symbol
                                           "*"
                                            3
                                            11 11
                                  res
                                ret
                                             null
                                              1
                                num_spaces
                                num_stars
                                              3
                                              11 11
                                spaces
stack
                                ret
                                             null
                                              2
                                num_spaces
                                num_stars
                                               1
                                spaces
                                stars
                                    ret null
                                           3
heap
                                        (symbol,n) => ...
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                            (n) => ...
```

```
globals
                                  ret
                                           null
                                  symbol
                                           "*"
                                            3
                                            11 11
                                  res
                                ret
                                             null
                                              1
                                num_spaces
                                num_stars
                                              3
                                              11 11
                                spaces
stack
                                ret
                                             null
                                              2
                                num_spaces
                                num_stars
                                               1
                                spaces
                                stars
                                    ret null
                                           3
heap
                                        (symbol,n) => ...
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                            (n) => ...
```

```
globals
                                  ret
                                          null
                                  symbol
                                           "*"
                                            3
                                           "*"
                                  res
                                ret
                                            null
                                              1
                                num_spaces
                                num_stars
                                              3
                                             11 11
                                spaces
stack
                                ret
                                            null
                                              2
                                num_spaces
                                num_stars
                                              1
                                spaces
                                stars
                                    ret null
                                          3
heap
                                        (symbol,n) => ...
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
```

```
globals
                                  ret
                                          null
                                  symbol
                                           "*"
                                            2
                                           "*"
                                  res
                                ret
                                            null
                                              1
                                num_spaces
                                num_stars
                                              3
                                             11 11
                                spaces
stack
                                ret
                                             null
                                              2
                                num_spaces
                                num_stars
                                              1
                                spaces
                                stars
                                    ret null
                                          3
heap
                                        (symbol,n) => ...
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
```

```
globals
                                  ret
                                          null
                                  symbol
                                           "*"
                                            2
                                           "*"
                                  res
                                ret
                                            null
                                              1
                                num_spaces
                                num_stars
                                              3
                                             11 11
                                spaces
stack
                                ret
                                            null
                                              2
                                num_spaces
                                num_stars
                                              1
                                spaces
                                stars
                                   ret null
                                          3
heap
                                        (symbol,n) => ...
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
```

```
globals
                                   ret
                                            null
                                   symbol
                                             "*"
                                              2
                                            "**"
                                   res
                                 ret
                                              null
                                                1
                                 num_spaces
                                 num_stars
                                                3
                                               11 11
                                 spaces
stack
                                 ret
                                              null
                                                2
                                 num_spaces
                                 num_stars
                                                1
                                 spaces
                                 stars
                                     ret null
                                            3
heap
                                         (symbol,n) => ...
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                             (n) \Rightarrow \dots
```

```
globals
                                  ret
                                          null
                                  symbol
                                           "*"
                                            1
                                          "**"
                                  res
                                ret
                                            null
                                              1
                                num_spaces
                                num_stars
                                              3
                                             11 11
                                spaces
stack
                                ret
                                            null
                                              2
                                num_spaces
                                num_stars
                                              1
                                spaces
                                stars
                                   ret null
                                          3
heap
                                        (symbol,n) => ...
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
```

```
globals
                                   ret
                                            null
                                   symbol
                                             "*"
                                             1
                                            "**"
                                   res
                                 ret
                                              null
                                                1
                                 num_spaces
                                 num_stars
                                                3
                                               11 11
                                 spaces
stack
                                 ret
                                              null
                                                2
                                 num_spaces
                                 num_stars
                                                1
                                 spaces
                                 stars
                                     ret null
                                            3
heap
                                         (symbol,n) => ...
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                             (n) \Rightarrow \dots
```

```
globals
                                 ret
                                          null
                                 symbol
                                           "*"
                                            1
                                          "***"
                                 res
                                ret
                                            null
                                              1
                                num_spaces
                                num_stars
                                              3
                                             11 11
                                spaces
stack
                                ret
                                            null
                                              2
                                num_spaces
                                num_stars
                                              1
                                spaces
                                stars
                                   ret null
                                          3
heap
                                        (symbol,n) => ...
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
```

```
globals
                                   ret
                                            null
                                   symbol
                                             "*"
                                              0
                                            "***"
                                   res
                                 ret
                                              null
                                                1
                                 num_spaces
                                 num_stars
                                                3
                                               11 11
                                 spaces
stack
                                 ret
                                              null
                                                2
                                 num_spaces
                                 num_stars
                                                1
                                 spaces
                                 stars
                                     ret null
                                            3
heap
                                         (symbol,n) => ...
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                             (n) \Rightarrow \dots
```

```
globals
                                 ret
                                          null
                                 symbol
                                           "*"
                                            0
                                          "***"
                                 res
                                ret
                                            null
                                              1
                                num_spaces
                                num_stars
                                              3
                                             11 11
                                spaces
stack
                                ret
                                            null
                                              2
                                num_spaces
                                num_stars
                                              1
                                spaces
                                stars
                                   ret null
                                          3
heap
                                        (symbol,n) => ...
              repeat
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
              draw_pyramid
                                           (n) => ...
```

```
globals
                                   ret
                                            "***"
                                   symbol
                                             "*"
                                            "***"
                                   res
                                               null
                                 ret
                                                 1
                                  num_spaces
                                  num_stars
                                                 3
                                  spaces
stack
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                   ret
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                              (n) => ...
globals
                                 ret
                                               null
                                  num_spaces
                                                 1
                                 num_stars
                                                 3
                                                11 11
                                  spaces
                                 ret
                                               null
                                                 2
stack
                                  num_spaces
                                                 1
                                  num_stars
                                  spaces
                                  stars
                                           null
                                     ret
                                             3
heap
                                          (symbol,n) => \dots
               repeat
definitions
               draw_pyramid_AUX
                                   (num_spaces,num_stars) => ...
                                              (n) => ...
               draw_pyramid
```

```
globals
                                ret
                                              null
                                num_spaces
                                               1
                                num_stars
                                              11 11
                                spaces
                                             "***"
                                stars
                                              null
                                 ret
stack
                                              2
                                 num_spaces
                                 num_stars
                                 spaces
                                              "*"
                                 stars
                                    ret null
                                           3
                                    n
heap
               repeat
                                         (symbol,n) \Rightarrow \dots
              draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                            (n) => ...
```

```
globals
                                 ret
                                              null
                                 num_spaces
                                               0
                                 num_stars
                                               5
                                ret
                                              null
                                               1
                                num_spaces
                                num_stars
                                               3
                                              11 11
                                spaces
                                stars
                                             "***"
stack
                                 ret
                                              null
                                 num_spaces
                                               2
                                 num_stars
                                               1
                                 spaces
                                 stars
                                     ret null
                                            3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                            (n) \Rightarrow \dots
```

```
globals
                                  ret
                                               null
                                  num_spaces
                                                 0
                                  num_stars
                                                 5
                                 ret
                                               null
                                                 1
                                 num_spaces
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                 stars
                                               "***"
stack
                                  ret
                                               null
                                  num_spaces
                                                 2
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) \Rightarrow \dots
```

```
globals
                                   ret
                                           null
                                   symbol
                                ret
                                             null
                                               0
                                num_spaces
                                num_stars
                                               5
                                ret
                                             null
                                               1
                                num_spaces
                                num_stars
                                               3
stack
                                              11 11
                                spaces
                                stars
                                             "***"
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                               1
                                 spaces
                                 stars
                                         null
                                    ret
                                           3
heap
                                         (symbol,n) => \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
                                            (n) => ...
               draw_pyramid
```

```
globals
                                   ret
                                            null
                                   symbol
                                             11 11
                                   res
                                 ret
                                              null
                                               0
                                 num_spaces
                                 num_stars
                                               5
                                ret
                                              null
                                               1
                                num_spaces
                                num_stars
stack
                                spaces
                                stars
                                             "***"
                                 ret
                                              null
                                 num_spaces
                                               2
                                 num_stars
                                 spaces
                                 stars
                                    ret null
                                            3
                                    n
{\tt heap}
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) => ...
```

```
globals
                                   ret
                                            null
                                   symbol
                                             11 11
                                   res
                                 ret
                                              null
                                                0
                                 num_spaces
                                 num_stars
                                                5
                                ret
                                              null
                                               1
                                num_spaces
                                num_stars
                                                3
stack
                                spaces
                                stars
                                              "***"
                                 ret
                                              null
                                 num_spaces
                                                2
                                 num_stars
                                 spaces
                                 stars
                                    ret null
                                            3
                                    n
{\tt heap}
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) => ...
```

```
globals
                                              11 11
                                     ret
                                     symbol
                                              11 11
                                     res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                  num_stars
                                                 5
                                 ret
                                               null
                                                 1
                                 num_spaces
                                 num_stars
                                                 3
stack
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                  num_spaces
                                                 2
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                   ret
                                   n
                                             3
{\tt heap}
                                          (symbol,n) => ...
               repeat
               draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
               draw_pyramid
                                              (n) => ...
```

```
globals
                                ret
                                              null
                                num_spaces
                                               0
                                               5
                                num_stars
                                ret
                                              null
                                               1
                                num_spaces
                                num_stars
                                               3
                                              11 11
                                spaces
                                stars
                                             "***"
stack
                                ret
                                              null
                                num_spaces
                                               2
                                num_stars
                                               1
                                 spaces
                                 stars
                                    ret null
                                           3
heap
                                         (symbol,n) => ...
              repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                            (n) \Rightarrow \dots
```

```
globals
                                ret
                                             null
                                num_spaces
                                              0
                                num_stars
                                spaces
                               ret
                                             null
                                              1
                               num_spaces
                                              3
                               num_stars
                                             11 11
                               spaces
stack
                                stars
                                            "***"
                                ret
                                             null
                                              2
                                num_spaces
                                num_stars
                                              1
                                spaces
                                stars
                                    ret null
                                           3
                                    n
heap
                                        (symbol,n) => \dots
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                            (n) => ...
```

```
globals
                                   ret
                                            null
                                   symbol
                                             "*"
                                 ret
                                              null
                                 num_spaces
                                                0
                                                5
                                 num_stars
                                               11 11
                                 spaces
                                ret
                                              null
                                                1
                                num_spaces
                                num_stars
                                                3
stack
                                spaces
                                              "***"
                                stars
                                 ret
                                              null
                                 num_spaces
                                                2
                                 num_stars
                                 spaces
                                 stars
                                  ret
                                          null
                                  n
{\tt heap}
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) => ...
```

```
globals
                                     ret
                                              null
                                     symbol
                                              "*"
                                               5
                                               11 11
                                     res
                                  ret
                                                null
                                                  0
                                  num_spaces
                                                  5
                                  num_stars
                                                 11 11
                                  spaces
                                                null
                                  ret
                                                  1
                                  num_spaces
stack
                                  num_stars
                                                  3
                                                11 11
                                  spaces
                                                "***"
                                  stars
                                  ret
                                                null
                                                 2
                                  num_spaces
                                  num_stars
                                                  1
                                  spaces
                                  stars
                                      ret null
                                              3
heap
                                           (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
                draw_pyramid
                                               (n) => ...
```

```
globals
                                     ret
                                              null
                                     symbol
                                              "*"
                                               5
                                               11 11
                                     res
                                  ret
                                                null
                                                  0
                                  num_spaces
                                                  5
                                  num_stars
                                                 11 11
                                  spaces
                                  ret
                                                null
                                                  1
                                  num_spaces
stack
                                  num_stars
                                                  3
                                                 11 11
                                  spaces
                                                "***"
                                  stars
                                  ret
                                                null
                                                 2
                                  num_spaces
                                  num_stars
                                                  1
                                  spaces
                                                 "*"
                                  stars
                                      ret null
                                              3
heap
                                           (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                               (n) => ...
```

```
globals
                                    ret
                                             null
                                    symbol
                                              "*"
                                               5
                                              "*"
                                    res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                                 5
                                  num_stars
                                                 11 11
                                  spaces
                                               null
                                 ret
                                                 1
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                           (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                    ret
                                             null
                                    symbol
                                              "*"
                                               4
                                              "*"
                                    res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                                 5
                                  num_stars
                                                 11 11
                                  spaces
                                               null
                                 ret
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                    ret
                                             null
                                    symbol
                                              "*"
                                               4
                                              "*"
                                    res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                                 5
                                  num_stars
                                                 11 11
                                  spaces
                                               null
                                 ret
                                                 1
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                           (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                    ret
                                             null
                                    symbol
                                              "*"
                                               4
                                             "**"
                                    res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                                 5
                                  num_stars
                                                 11 11
                                  spaces
                                               null
                                 ret
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                    ret
                                             null
                                    symbol
                                              "*"
                                               3
                                             "**"
                                    res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                                 5
                                  num_stars
                                                 11 11
                                  spaces
                                               null
                                 ret
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                    ret
                                             null
                                    symbol
                                              "*"
                                               3
                                             "**"
                                    res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                                 5
                                  num_stars
                                                11 11
                                  spaces
                                               null
                                 ret
                                                 1
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                    ret
                                             null
                                    symbol
                                              "*"
                                               3
                                             "***"
                                    res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                                 5
                                  num_stars
                                                 11 11
                                  spaces
                                               null
                                 ret
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                    ret
                                             null
                                    symbol
                                              "*"
                                               2
                                             "***"
                                    res
                                  ret
                                               null
                                                 0
                                  num_spaces
                                                 5
                                  num_stars
                                                 11 11
                                  spaces
                                               null
                                 ret
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                 spaces
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                      ret null
                                             3
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                              (n) => ...
```

```
globals
                                  ret
                                            null
                                  symbol
                                            "*"
                                             2
                                           "***"
                                  res
                                 ret
                                              null
                                               0
                                 num_spaces
                                               5
                                 num_stars
                                               11 11
                                 spaces
                                              null
                                ret
                                num_spaces
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                 ret
                                              null
                                               2
                                 num_spaces
                                 num_stars
                                               1
                                 spaces
                                 stars
                                    ret null
                                            3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) => ...
```

```
globals
                                  ret
                                            null
                                  symbol
                                            "*"
                                             2
                                  res
                                           "****"
                                 ret
                                              null
                                               0
                                 num_spaces
                                               5
                                 num_stars
                                               11 11
                                 spaces
                                              null
                                ret
                                num_spaces
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                 ret
                                              null
                                               2
                                 num_spaces
                                 num_stars
                                               1
                                 spaces
                                 stars
                                    ret null
                                            3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) => ...
```

```
globals
                                  ret
                                           null
                                  symbol
                                            "*"
                                             1
                                  res
                                          "****"
                                ret
                                             null
                                               0
                                 num_spaces
                                               5
                                num_stars
                                               11 11
                                 spaces
                                             null
                                ret
                                num_spaces
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                               1
                                 spaces
                                 stars
                                    ret null
                                           3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                            (n) => ...
```

```
globals
                                  ret
                                           null
                                  symbol
                                            "*"
                                             1
                                  res
                                          "****"
                                ret
                                             null
                                               0
                                 num_spaces
                                               5
                                num_stars
                                               11 11
                                 spaces
                                             null
                                ret
                                num_spaces
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                               1
                                 spaces
                                 stars
                                    ret null
                                           3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                            (n) => ...
```

```
globals
                                 ret
                                           null
                                 symbol
                                            "*"
                                             1
                                          "*****"
                                 res
                                ret
                                             null
                                               0
                                 num_spaces
                                               5
                                num_stars
                                               11 11
                                 spaces
                                             null
                                ret
                                num_spaces
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                               1
                                 spaces
                                 stars
                                    ret null
                                           3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                            (n) => ...
```

```
globals
                                 ret
                                           null
                                 symbol
                                            "*"
                                             0
                                          "*****"
                                 res
                                ret
                                             null
                                               0
                                 num_spaces
                                               5
                                num_stars
                                               11 11
                                 spaces
                                             null
                                ret
                                num_spaces
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                               1
                                 spaces
                                 stars
                                    ret null
                                           3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                            (n) => ...
```

```
globals
                                 ret
                                           null
                                 symbol
                                            "*"
                                             0
                                          "*****"
                                 res
                                ret
                                             null
                                               0
                                 num_spaces
                                               5
                                num_stars
                                               11 11
                                 spaces
                                             null
                                ret
                                num_spaces
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                               1
                                 spaces
                                 stars
                                    ret null
                                           3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                            (n) => ...
```

```
globals
                                          "****
                                 ret
                                 symbol
                                          "*****"
                                 res
                                 ret
                                              null
                                               0
                                 num_spaces
                                               5
                                 num_stars
                                               11 11
                                 spaces
                                ret
                                              null
                                               1
                                num_spaces
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                 ret
                                              null
                                               2
                                 num_spaces
                                 num_stars
                                               1
                                 spaces
                                 stars
                                  ret
                                            3
heap
                                         (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) => ...
```

```
globals
                                ret
                                             null
                                num_spaces
                                              0
                                num_stars
                                spaces
                               ret
                                             null
                                              1
                               num_spaces
                                              3
                               num_stars
                                             11 11
                               spaces
stack
                               stars
                                            "***"
                                ret
                                             null
                                              2
                                num_spaces
                                num_stars
                                              1
                                spaces
                                stars
                                   ret null
                                          3
                                   n
heap
                                        (symbol,n) => \dots
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                           (n) => ...
```

```
globals
                                 ret
                                                 null
                                 num_spaces
                                                   0
                                                   5
                                 num_stars
                                                  11 11
                                 spaces
                                               "****
                                 stars
                                                 null
                                  ret
                                                   1
                                  num_spaces
                                  num_stars
                                                   3
                                  spaces
                                                  11 11
stack
                                                 "***"
                                  stars
                                   ret
                                                 null
                                   num_spaces
                                                   2
                                   num_stars
                                                   1
                                   spaces
                                   stars
                                                  "*"
                                             null
                                       ret
                                               3
heap
                repeat
                                            (symbol,n) => \dots
definitions
                                     (num_spaces,num_stars) => ...
                {\tt draw\_pyramid\_AUX}
                draw_pyramid
                                                (n) \Rightarrow \dots
```

```
globals
                                ret
                                             null
                                num_spaces
                                              -1
                                               7
                                num_stars
                                             null
                               ret
                                               0
                               num_spaces
                               num_stars
                                               5
                                              11 11
                               spaces
                               stars
                                            "****
                                ret
                                             null
                                num_spaces
                                               1
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                               1
                                spaces
                                              "*"
                                stars
                                    ret null
                                           3
heap
                                         (symbol,n) => ...
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                            (n) => ...
```

```
globals
                                ret
                                             null
                                num_spaces
                                              -1
                                               7
                                num_stars
                                             null
                               ret
                                               0
                               num_spaces
                               num_stars
                                               5
                                              11 11
                               spaces
                               stars
                                            "****
                                ret
                                             null
                                num_spaces
                                               1
stack
                                num_stars
                                               3
                                              11 11
                                spaces
                                             "***"
                                stars
                                ret
                                             null
                                               2
                                num_spaces
                                num_stars
                                               1
                                spaces
                                              "*"
                                stars
                                    ret null
                                           3
heap
                                         (symbol,n) => ...
              repeat
definitions
              draw_pyramid_AUX (num_spaces,num_stars) => ...
              draw_pyramid
                                            (n) => ...
```

```
globals
                                   ret
                                   num_spaces
                                                 -1
                                   num_stars
                                                 7
                                                null
                                ret
                                                 0
                                num_spaces
                                num_stars
                                                 5
                                                 11 11
                                spaces
                                              "*****"
                                stars
                                 ret
                                                null
                                                 1
                                 num_spaces
stack
                                 num_stars
                                                 3
                                                11 11
                                  spaces
                                               "***"
                                  stars
                                  ret
                                                null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                                "*"
                                  stars
                                    ret
                                             3
heap
                                           (symbol,n) => ...
               repeat
definitions
               draw_pyramid_AUX
                                    (num_spaces,num_stars) => ...
               draw_pyramid
                                               (n) \Rightarrow \dots
```

```
globals
                                 ret
                                                 null
                                 num_spaces
                                                   0
                                                   5
                                 num_stars
                                                  11 11
                                 spaces
                                                "****
                                 stars
                                                 null
                                  ret
                                                   1
                                  num_spaces
                                  num_stars
                                                   3
                                   spaces
                                                  11 11
stack
                                                 "***"
                                   stars
                                   ret
                                                 null
                                   num_spaces
                                                   2
                                   num_stars
                                                   1
                                   spaces
                                   stars
                                                  "*"
                                             null
                                       ret
                                               3
heap
                repeat
                                            (symbol,n) => \dots
definitions
                                     (num_spaces,num_stars) => ...
                {\tt draw\_pyramid\_AUX}
                draw_pyramid
                                                (n) \Rightarrow \dots
```

```
globals
                                            "****\n"
                               num_spaces
                                                 0
                               num_stars
                                                 5
                                                " "
                               spaces
                                              "****
                               stars
                                               null
                                 ret
                                                 1
                                 num_spaces
                                 num_stars
                                                 3
                                 spaces
                                                11 11
stack
                                               "***"
                                 stars
                                  ret
                                               null
                                                 2
                                  num_spaces
                                  num_stars
                                                 1
                                  spaces
                                  stars
                                                "*"
                                   ret
                                             3
                                   n
heap
                                          (symbol,n) => ...
               repeat
definitions
                                    (num_spaces,num_stars) => ...
               {\tt draw\_pyramid\_AUX}
                                              (n) => ...
               draw_pyramid
```

```
globals
                                                null
                                  ret
                                  num_spaces
                                                  1
                                  num_stars
                                  spaces
                                                "***"
                                  stars
                                   ret
                                                null
stack
                                   num_spaces
                                                  2
                                   num_stars
                                   spaces
                                                 "*"
                                   stars
                                       ret null
                                              3
                                       n
heap
                                           (symbol,n) \Rightarrow \dots
                repeat
                draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
                draw_pyramid
                                               (n) \Rightarrow \dots
globals
                            ret
                                          " ***\n****\n"
                            num_spaces
                                                  1
                            num_stars
                                                  3
                            spaces
                                                "***"
                            stars
                                  ret
                                                null
stack
                                                  2
                                   num_spaces
                                   num_stars
                                                  1
                                   spaces
                                                 "*"
                                   stars
                                    ret
                                              3
heap
                                           (symbol,n) => \dots
                repeat
                draw_pyramid_AUX (num_spaces,num_stars) => ...
definitions
                draw_pyramid
                                               (n) \Rightarrow \dots
```

```
globals
                                 ret
                                               null
                                 num_spaces
                                                2
                                  num_stars
{\tt stack}
                                  spaces
                                               "*"
                                  stars
                                     ret
                                           null
                                            3
                                     n
heap
                                          (symbol,n) => \dots
               repeat
definitions
                                   (num_spaces,num_stars) => ...
               draw_pyramid_AUX
               draw_pyramid
                                             (n) => ...
globals
                                         *\n ***\n****\n"
                        ret
                                                2
                        num_spaces
                        num_stars
                                                1
stack
                         spaces
                         stars
                                   ret
                                            3
                                   n
heap
                                          (symbol,n) => \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
                                              (n) => ...
               draw_pyramid
globals
                                     ret null
{\tt stack}
                                            3
                                     n
heap
                                          (symbol,n) \Rightarrow \dots
               repeat
definitions
               draw_pyramid_AUX (num_spaces,num_stars) => ...
               draw_pyramid
                                             (n) => ...
```

```
globals
                                 " *\n ***\n****\n"
 stack
                                             3
 heap
                repeat
                                          (symbol,n) => ...
 definitions
                draw_pyramid_AUX (num_spaces,num_stars) => ...
                draw_pyramid
                                              (n) => ...
 globals
 stack
 heap
                                          (symbol,n) => \dots
                repeat
                draw_pyramid_AUX (num_spaces,num_stars) => ...
 definitions
                draw_pyramid
                                              (n) => ...
 globals
                                   res
 stack
 heap
                repeat
                                          (symbol,n) \Rightarrow \dots
                draw_pyramid_AUX
                                    (num_spaces,num_stars) => ...
 definitions
                draw_pyramid
                                              (n) => ...
print (" *\n ***\n****\n")
 globals
                            res "
                                     *\n ***\n****\n"
 stack
 heap
                                          (symbol,n) \Rightarrow \dots
                repeat
                draw_pyramid_AUX (num_spaces,num_stars) => ...
 definitions
                draw_pyramid
                                              (n) \Rightarrow \dots
                                  *\n ***\n****\n"
 output
```