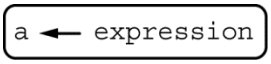
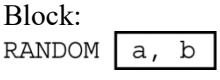
REFERENCE MATERIALS

Instruction	Explanation
Assignment, Display, and Input	
Text: `a ← expression` Block: 	Evaluates `expression` and then assigns a copy of the result to the variable `a`.
Text: `DISPLAY(expression)` Block: 	Displays the value of `expression`, followed by a space.

Text:
`INPUT()`
 	
Block:
`INPUT`
	Accepts a value from the user and returns the input value.

Arithmetic Operators and Numeric Procedures	

Text and Block:
`a + b`
`a - b`
`a * b`
`a / b`
	The arithmetic operators `+`, `-`, `*`, and `/` are used to perform arithmetic on `a` and `b`.
	
	For example, `17 / 5` evaluates to `3.4`.
	
	The order of operations used in mathematics applies when evaluating expressions.

Text and Block: `a MOD b`	Evaluates to the remainder when `a` is divided by `b`. Assume that `a` is an integer greater than or equal to `0` and `b` is an integer greater than `0`. For example, `17 MOD 5` evaluates to `2`. The `MOD` operator has the same precedence as the `*` and `/` operators.
Text: `RANDOM(a, b)` Block: 	Generates and returns a random integer from `a` to `b`, including `a` and `b`. Each result is equally likely to occur. For example, `RANDOM(1, 3)` could return `1`, `2`, or `3`.
Relational and Boolean Operators	

Text and Block:
`a = b`
`a ≠ b`
`a > b`
`a < b`
`a ≥ b`
`a ≤ b`
	The relational operators `=`, `≠`, `>`, `<`, `≥`, and `≤` are used to test the relationship between two variables, expressions, or values. A comparison using relational operators evaluates to a Boolean value.
	
	For example, `a = b` evaluates to `true` if `a` and `b` are equal; otherwise it evaluates to `false`.

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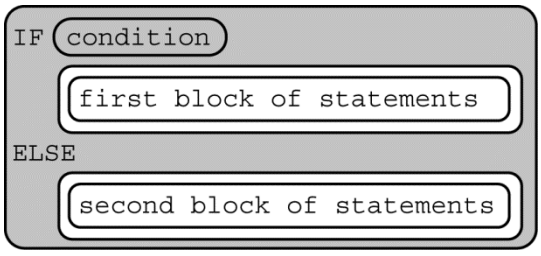
Instruction	Explanation
Relational and Boolean Operators (continued)	
Text: `NOT condition` Block: `NOT` (`condition`)	Evaluates to `true` if `condition` is `false`; otherwise evaluates to `false`.
Text: `condition1 AND condition2` Block: (`condition1`) `AND` (`condition2`)	Evaluates to `true` if both `condition1` and `condition2` are `true`; otherwise evaluates to `false`.
Text: `condition1 OR condition2` Block: (`condition1`) `OR` (`condition2`)	Evaluates to `true` if `condition1` is `true` or if `condition2` is `true` or if both `condition1` and `condition2` are `true`; otherwise evaluates to `false`.
Selection	

Text:
`IF(condition)`
`{`
`  <block of statements>`
`}`
 	
Block:
 
	The code in `block of statements` is executed if the Boolean expression `condition` evaluates to `true`; no action is taken if `condition` evaluates to `false`.

Text:
`IF(condition)`
`{`
`  <first block of statements>`
`}`
`ELSE`
`{`
`  <second block of statements>`
`}`
 	
Block:
 
	The code in `first block of statements` is executed if the Boolean expression `condition` evaluates to `true`; otherwise the code in `second block of statements` is executed.

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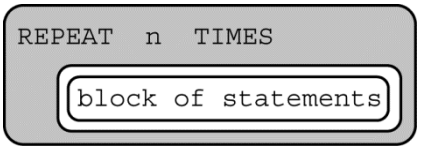
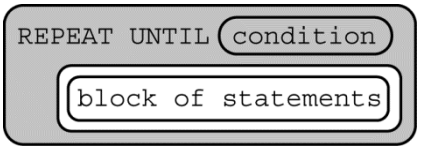
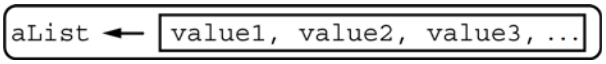
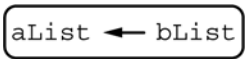
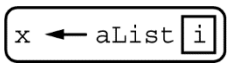
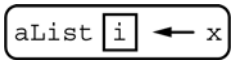
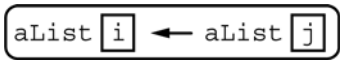
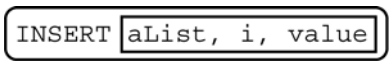
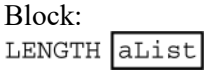
Instruction	Explanation
Iteration	

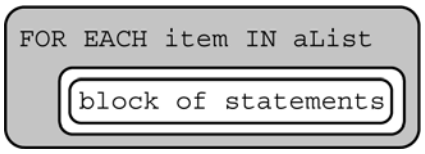
Text:
`REPEAT n TIMES`
`{`
`  <block of statements>`
`}`
 	
Block:
 
	The code in `block of statements` is executed `n` times.

Text:
`REPEAT UNTIL(condition)`
`{`
`  <block of statements>`
`}`
 	
Block:
 
	The code in `block of statements` is repeated until the Boolean expression `condition` evaluates to `true`.

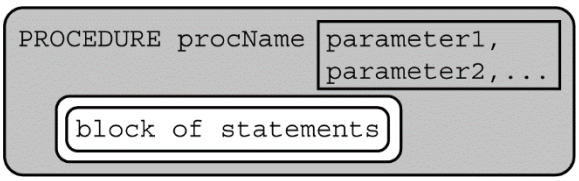
List Operations	
For all list operations, if a list index is less than 1 or greater than the length of the list, an error message is produced and the program terminates.	
Text: `aList ← [value1, value2, value3, ...]` Block: 	Creates a new list that contains the values `value1`, `value2`, `value3`, and `...` at indices `1`, `2`, `3`, and `...` respectively and assigns it to `aList`.
Text: `aList ← []` Block: 	Creates an empty list and assigns it to `aList`.
Text: `aList ← bList` Block: 	Assigns a copy of the list `bList` to the list `aList`. For example, if `bList` contains `[20, 40, 60]`, then `aList` will also contain `[20, 40, 60]` after the assignment.
Text: `aList[i]` Block: 	Accesses the element of `aList` at index `i`. The first element of `aList` is at index `1` and is accessed using the notation `aList[1]`.

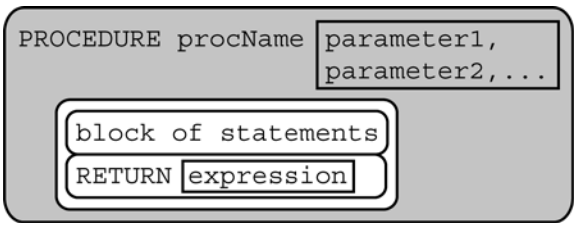
REFERENCE MATERIALS

Instruction	Explanation
List Operations (continued)	
Text: `x ← aList[i]` Block: 	Assigns the value of `aList[i]` to the variable `x`.
Text: `aList[i] ← x` Block: 	Assigns the value of `x` to `aList[i]`.
Text: `aList[i] ← aList[j]` Block: 	Assigns the value of `aList[j]` to `aList[i]`.
Text: `INSERT(aList, i, value)` Block: 	Any values in `aList` at indices greater than or equal to `i` are shifted one position to the right. The length of the list is increased by 1, and `value` is placed at index `i` in `aList`.
Text: `APPEND(aList, value)` Block: 	The length of `aList` is increased by 1, and `value` is placed at the end of `aList`.
Text: `REMOVE(aList, i)` Block: 	Removes the item at index `i` in `aList` and shifts to the left any values at indices greater than `i`. The length of `aList` is decreased by 1.
Text: `LENGTH(aList)` Block: 	Evaluates to the number of elements in `aList`.

Text:
`FOR EACH item IN aList`
`{`
`  <block of statements>`
`}`
 	
Block:
 
	The variable `item` is assigned the value of each element of `aList` sequentially, in order, from the first element to the last element. The code in `block of statements` is executed once for each assignment of `item`.

REFERENCE MATERIALS

<table>
<tr><th>Instruction</th><th>Explanation</th></tr>
<tr><td colspan="2">Procedures and Procedure Calls</td></tr>
<tr><td>Text:
<pre>
PROCEDURE procName(parameter1,
                   parameter2, ...)
{
   <block of statements>
}
</pre>
Block:

</td><td>Defines <code>procName</code> as a procedure that takes zero or more arguments. The procedure contains <code>block of statements</code>.

The procedure <code>procName</code> can be called using the following notation, where <code>arg1</code> is assigned to <code>parameter1</code>, <code>arg2</code> is assigned to <code>parameter2</code>, etc.:
<code>procName(arg1, arg2, ...)</code></td></tr>
<tr><td>Text:
<pre>
PROCEDURE procName(parameter1,
                   parameter2, ...)
{
   <block of statements>
   RETURN(expression)
}
</pre>
Block:

</td><td>Defines <code>procName</code> as a procedure that takes zero or more arguments. The procedure contains <code>block of statements</code> and returns the value of <code>expression</code>. The <code>RETURN</code> statement may appear at any point inside the procedure and causes an immediate return from the procedure back to the calling statement.

The value returned by the procedure <code>procName</code> can be assigned to the variable <code>result</code> using the following notation:
<code>result ← procName(arg1, arg2, ...)</code></td></tr>
<tr><td>Text:
<pre>
RETURN(expression)
</pre>
Block:

</td><td>Returns the flow of control to the point where the procedure was called and returns the value of <code>expression</code>.</td></tr>
</table>

REFERENCE MATERIALS

Instruction	Explanation
Robot	
If the robot attempts to move to a square that is not open or is beyond the edge of the grid, the robot will stay in its current location and the program will terminate.	

Text:
`MOVE_FORWARD()`
 	
Block:
`MOVE_FORWARD`
	The robot moves one square forward in the direction it is facing.

Text:
`ROTATE_LEFT()`
 	
Block:
`ROTATE_LEFT`
	The robot rotates in place 90 degrees counterclockwise (i.e., makes an in-place left turn).

Text:
`ROTATE_RIGHT()`
 	
Block:
`ROTATE_RIGHT`
	The robot rotates in place 90 degrees clockwise (i.e., makes an in-place right turn).

Text:
`CAN_MOVE(direction)`
 	
Block:
`CAN_MOVE` `direction`
	Evaluates to `true` if there is an open square one square in the direction relative to where the robot is facing; otherwise evaluates to `false`. The value of `direction` can be `left`, `right`, `forward`, or `backward`.