

Proof that $[0,1)$ is not countable

Suppose, for the sake of contradiction, that there is a list of them:

Number	Digits after decimal	0	1	2	3	4	5	6	7	...
$f(0)$	0.	3	3	3	3	3				
$f(1)$	0.	2	7	2	7	2				
$f(2)$	0.	1	4	1	5	9				
$f(3)$	0.	2	2	2	2	2				
$f(4)$	0.	1	2	3	4	5	6	7	8	...
$f(5)$	0.	9	8	7	6	5	4	3	2	...
$f(6)$	0.	8	2	7	6	4	5	7	4	...
$f(7)$	0.	5	9	4	2	7	5	1	7	...
...

Goal: find a real number between 0 and 1 that isn't on our table.
(contradiction to bijection)

A Very Tricky Program.

```
Diagonal.java(String x){
    Run H.exe on input <x, x>
    if(H.exe says "x halts on x")
        while(true){//Go into an infinite loop
            int x=2+2;
        }
    else //H.exe says "x doesn't halt on x"
        return; //halt.
}
```