# Approximation for Square Root

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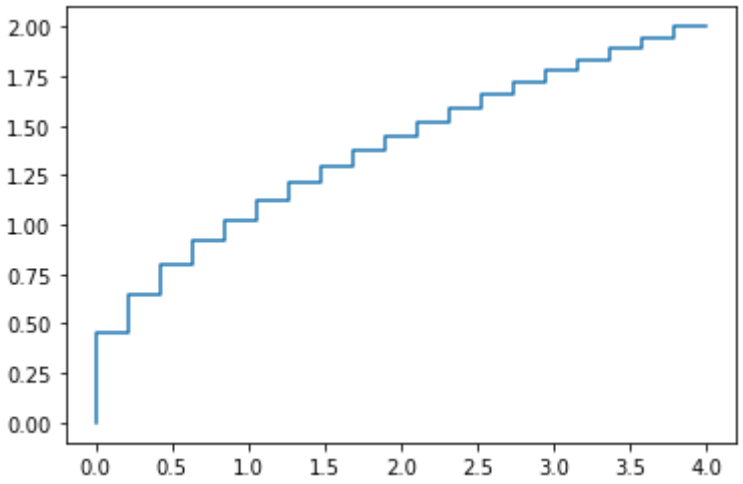
**$Idea$: Each cell in the middle layer will be active only if the input time(x) is greater than the bias. We calculate $\sqrt{0.1}$ for the first cell and make it the weight.** ¶

**If $0.2 > x \geq 0.3$, then first two cells will be active. Therefore weight for second cell will be $\sqrt{0.2} - \sqrt{0.1}$**

**Similarly for each next cell weight would be $\sqrt{n} - \sqrt{n - 0.1}$**

In [1]:
```
import numpy as np
from matplotlib import pyplot as plt

#Calculate root values for few inputs between 0-4
lst = np.linspace(0.0,4,20)
print("time",lst)
y=[]
for i in lst:
    y.append(i**0.5)

print("root",y)
plt.step(lst,y)
plt.show()
```

```
time [0.         0.21052632 0.42105263 0.63157895 0.84210526 1.05263158
 1.26315789 1.47368421 1.68421053 1.89473684 2.10526316 2.31578947
 2.52631579 2.73684211 2.94736842 3.15789474 3.36842105 3.57894737
 3.78947368 4.        ]
root [0.0, 0.45883146774112354, 0.6488856845230502, 0.7947194142390263,
0.9176629354822471, 1.025978352085154, 1.1239029738980326, 1.2139539573
337679, 1.2977713690461004, 1.3764944032233706, 1.4509525002200232, 1.5
217718205053643, 1.5894388284780525, 1.654340383737022, 1.7167901505579
042, 1.7770466332772772, 1.8353258709644942, 1.8918106058538344, 1.9466
570535691503, 2.0]
```




# Implementation

## Calculate root(n) - root(n-0.1) for each consecutive cells

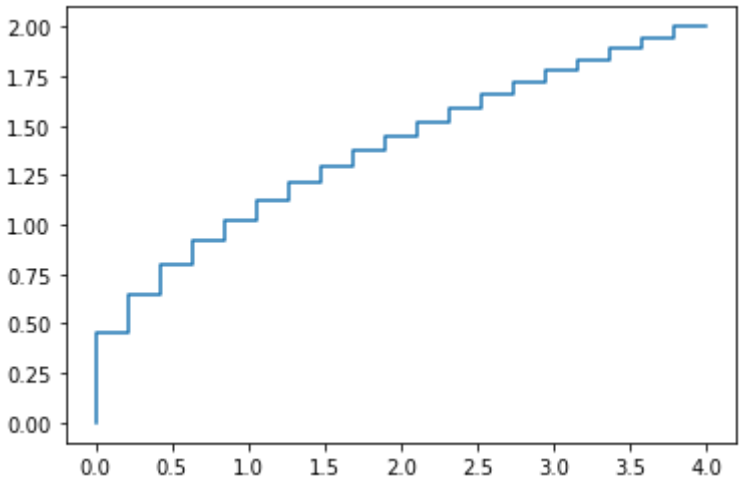
In [2]:
```
wts = []
wts.append(y[0])
print("Square root \n", y)

indx = 0
for i in y[1:]:
    wts.append(i-y[indx])
    indx+=1

print("\nWts \n",wts)
```

```
Square root
 [0.0, 0.45883146774112354, 0.6488856845230502, 0.7947194142390263, 0.9
176629354822471, 1.025978352085154, 1.1239029738980326, 1.2139539573337
679, 1.2977713690461004, 1.3764944032233706, 1.4509525002200232, 1.5217
718205053643, 1.5894388284780525, 1.654340383737022, 1.716790150557904
2, 1.7770466332772772, 1.8353258709644942, 1.8918106058538344, 1.946657
0535691503, 2.0]

Wts
 [0.0, 0.45883146774112354, 0.19005421678192663, 0.14583372971597608,
0.12294352124322083, 0.10831541660290689, 0.09792462181287864, 0.090050
98343573525, 0.08381741171233248, 0.07872303417727022, 0.07445809699665
262, 0.0708193202853411, 0.06766700797268821, 0.06490155525896957, 0.06
24497668208821, 0.060256482719373006, 0.05827923768721699, 0.0564847348
8934025, 0.05484644771531588, 0.05334294643084969]
```

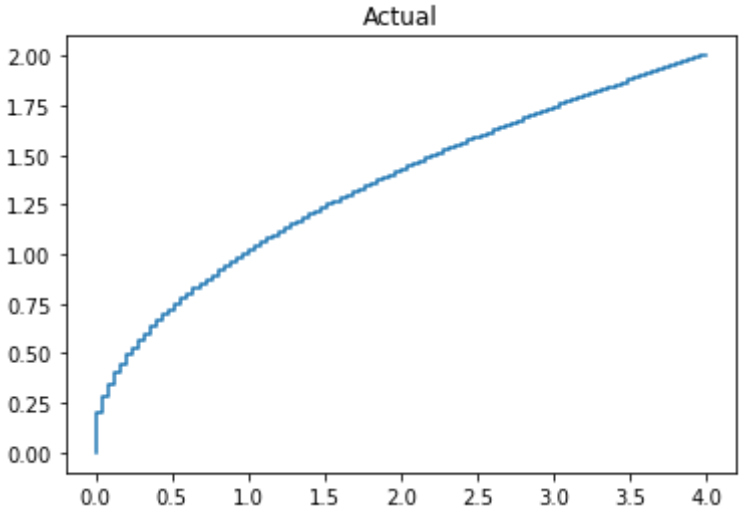
## Calculate output for the above network

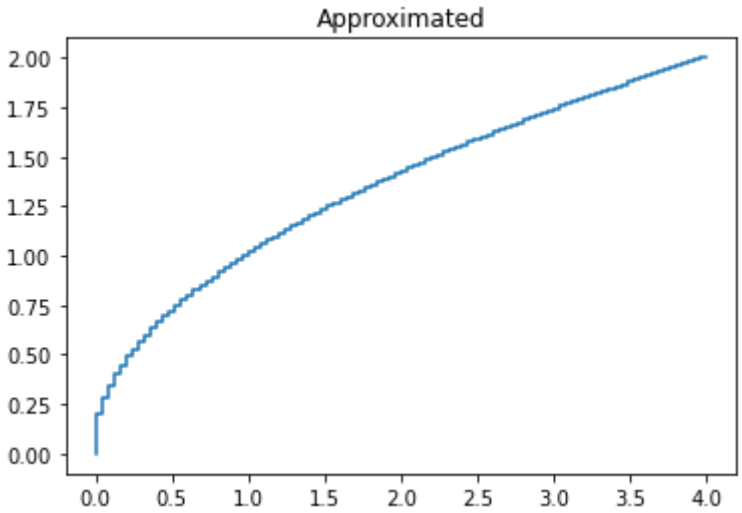
In [3]:
```
res = []
inx=1
for i in wts:
    #For each input x, sum of all the active cells less than it will be
 the output
    res.append(sum(wts[:inx]))
    inx+=1
print(res)
plt.step(lst,res)
plt.show()
```

```
[0.0, 0.45883146774112354, 0.6488856845230502, 0.7947194142390263, 0.91
76629354822471, 1.025978352085154, 1.1239029738980326, 1.21395395733376
79, 1.2977713690461004, 1.3764944032233706, 1.4509525002200232, 1.52177
18205053643, 1.5894388284780525, 1.654340383737022, 1.7167901505579042,
1.7770466332772772, 1.8353258709644942, 1.8918106058538344, 1.946657053
5691503, 2.0]
```



In [4]:
```
#Calculate root values for few inputs between 0-4
#Assumption we have few input and target values for training weights
lst = np.linspace(0.0,4,101)
# print("time",lst)
y=[]
for i in lst:
    y.append(i**0.5)


plt.step(lst,y)
plt.title("Actual")
plt.show()
wts = []
wts.append(y[0])


indx = 0
for i in y[1:]:
    wts.append(i-y[indx])
    indx+=1


res = []
indx=1
for i in wts:
    #For each input x, sum of all the active cells less than it will be
 the output
    res.append(sum(wts[:indx]))
    indx+=1

plt.step(lst,res)
plt.title("Approximated")
plt.show()
```


Actual
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0


Approximated
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0