

```

it[s_] := s ∪ Flatten[Outer[If[0 ≤ #1 - #2 ≤ 1, (#1 + #2 + 1) / 2, 0.] &, s, s]];
it[s_, max_] :=
  s ∪ Flatten[Outer[If[0 ≤ #1 - #2 ≤ 1, Min[(#1 + #2 + 1) / 2, max], 0.] &, s, s]]

it@{0}

{0,  $\frac{1}{2}$ }

itn[0] = {0.};
itn[n_] := itn[n] = it[itn[n-1]];
itn[0, max_] = {0., max};
itn[n_, max_] := itn[n, max] = it[itn[n-1, max], max]

itn[3]

{0., 0.5, 0.75, 0.875, 1., 1.125, 1.25, 1.375, 1.5}

itn[5]

{0., 0.5, 0.75, 0.875, 0.9375, 0.96875, 1., 1.125, 1.1875, 1.21875, 1.25, 1.3125,
  1.34375, 1.375, 1.40625, 1.4375, 1.46875, 1.5, 1.53125, 1.5625, 1.59375,
  1.625, 1.65625, 1.6875, 1.71875, 1.75, 1.78125, 1.8125, 1.84375, 1.875,
  1.90625, 1.9375, 1.96875, 2., 2.03125, 2.0625, 2.09375, 2.125, 2.15625, 2.1875,
  2.21875, 2.25, 2.28125, 2.3125, 2.34375, 2.375, 2.40625, 2.4375, 2.46875, 2.5}

itn[10] // Short

{0., 0.5, 0.75, 0.875, 0.9375, 0.96875, 0.984375,
  0.992188, 0.996094, 0.998047, <<3429>>, 4.99121, 4.99219,
  4.99316, 4.99414, 4.99512, 4.99609, 4.99707, 4.99805, 4.99902, 5.}

```

```
Graphics[Line[{{#, 0}, {#, 1}}] & /@ Itn[20, 1.75]]
```

