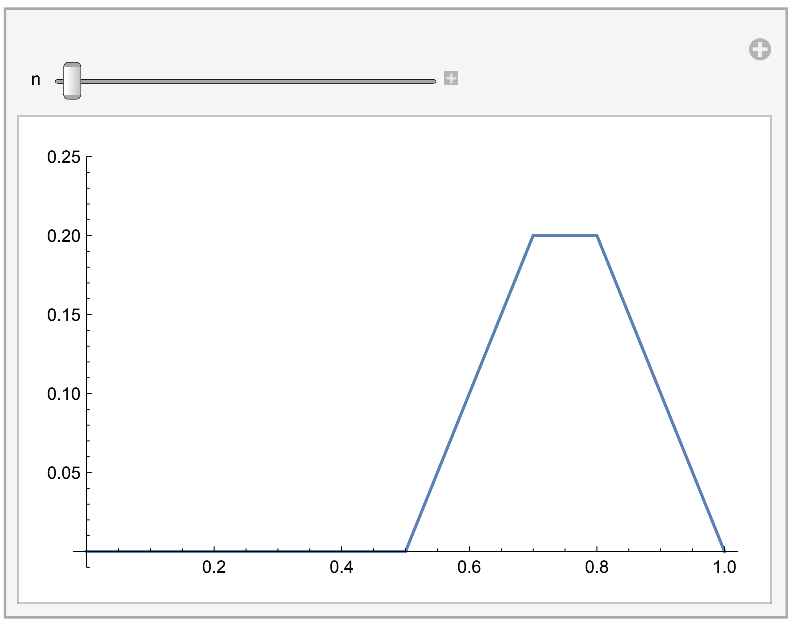
```
In[705]:= Clear[coord, L, nPart, dt, dx, k, s, xPos,
    u0, myTemp, uTemp, rightT, leftT, lastT, newT, newT];

  L := 1                (*Length of rod *)
  nPart := 10           (*Number of partitions *)
  nTsamples := 100      (*Number of time samples*)
  tTime := 10           (*How much time*)
  dt := tTime / nTsamples    (*Time interval size Δt*)
  dx := L / nPart            (*Section size Δx*)
  k := 1                     (*k value*)
  (*s=k*dt/(dx^2)*)            (*s constant*)
  s = 0.50
  (*Interesting to note that forcing various *)
  (*values on s affects the stability of the solution*)

  (*Here I define a function for the initial temperature distribution f0=f(x)*)

  (*f0[x_]:=Abs[Sin[6x]]+.2*)

  f0[x_] := Piecewise[{{0, x ≥ 0 && x < 0.5 L},
     {(x - 0.5 L) / L, x ≥ 0.5 L && x < 0.75 L}, {(0.75 L - x) / L + 0.25, x ≥ 0.75 L && x ≤ L}}]

  (*Here is where I define the initial conditions at t=0*)
  (*so u(x,0)=the function f0=f(x) acting on the xpos*)
  xPos := (Range[nPart] - 1) * dx

  (*This includes the very end of the rod*)
  AppendTo[xPos, dx * nPart];

  (*the symbol /@ maps the function onto xpos*)
  u0 := f0 /@ xPos

  (*Initialize the empty u temperature list, these are*)
  (*our sample solution points*)
  uTemp := {}

  (*At t=1 we have our u0 list of temps*)
  uTemp = Append[uTemp, u0];

  (*This nested for loop sequence calculates the temps at time*)
  (*t by using the difference equation on page 226 of the book*)
  (*this is also the same one we derived in class*)

  (*The outer loop only starts at t=2 because at t=1 this is t0 with*)
  (*initial temp of u0 which we append before the loop*)
  For[t = 2, t ≤ nTsamples, t++,

    (*Initialize an empty temporary list*)
    myTemp := {};

    (*This loop is where we go throuh each x and calculate*)
    (*u(x,t), where t is from the outer loop*)
    For[k = 1, k ≤ nPart + 1, k++,    (*Remember we added the end*)
     lastT = uTemp[[t - 1, k]];       (*so we need to go nPart+1*)
```

```
     (*if we are at start position x0 or in this case x1*)
     If[k == 1, rightT = 0;
      leftT = uTemp[[t - 1, k + 1]]];

     (*if we reach the end of the rod*)
     If[k == nPart + 1, leftT = 0; rightT = uTemp[[t - 1, k - 1]]];

     (*if we are inside rod*)
     If[k > 1 && k < nPart + 1,
      rightT = uTemp[[t - 1, k - 1]];
      leftT = uTemp[[t - 1, k + 1]]
     ];

     (*This is the relationship: u[j][m+1]=u[j][m]...from page 226*)
     newT = lastT + s * (leftT - 2 * lastT + rightT);

     (*append temperatures to temporary list we started with*)
     myTemp = Append[myTemp, newT];
    ];

    (*append the temp list to our uTemp list which we began before*)
    (*the outer loop*)
    uTemp = Append[uTemp, myTemp];
   ];
```

Out[713]= 0.5

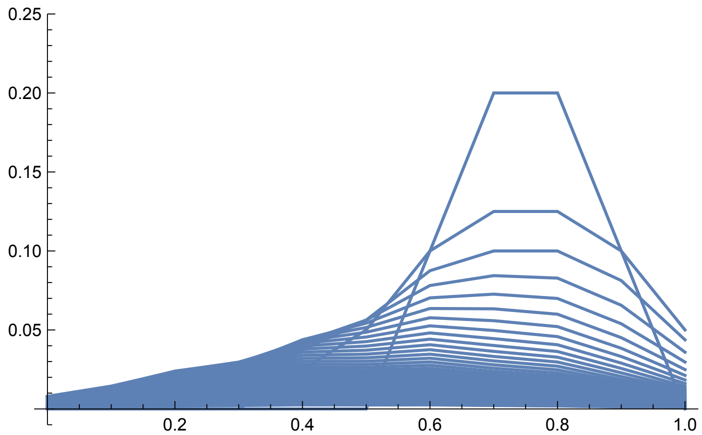
In[721]:=
```
(*Here we define individual frames representing the solution*)
(*at different times of t*)

(*Initialize an empty frame list, we will collect the frames*)
frames := {}

(*We need to get the coordinates of the xpos and utemp at*)
(*those xpos at time t here I accidentally used the letter k instead*)
For[k = 1, k ≤ nTsamples, k++,
  coord := {};

  For[i = 1, i ≤ nPart + 1, i++,
   coord = Append[coord, {xPos[[i]], uTemp[[k, i]]}];
  ];

  tempframe := ListLinePlot[coord, PlotRange → {-0.01, 0.25}];
  frames = Append[frames, tempframe];
 ];

(*Try manipulating the plot*)
Manipulate[Show[frames[[n]]], {n, 1, nTsamples, 1}]
```

Out[723]=



```
(*Here are the snapshots of the solution*)
myTablePlot = Table[Graphics[frames[[n]]], {n, 1, nTsamples, 2}];
Show[myTablePlot]
```

Out[725]=



In[726]:=
```
(*This will generate a contour and 3d plot overlayed together*)
coord := {};

For[t = 1, t ≤ nTsamples, t++,
  For[i = 1, i ≤ nPart + 1, i++,
    coord = Append[coord, {xPos[[i]], (t - 1) * dt, uTemp[[t, i]]}];
   ];
 ];

ctPlot = ListContourPlot[coord, ColorFunction -> "Rainbow"];
listPlot = ListPlot3D[coord, ColorFunction → "Rainbow", PlotRange → {-.01, 0.25}];

level = -0.01;
gr = Graphics3D[{Texture[ctPlot], EdgeForm[], Polygon[{{0, 0, level}, {L, 0, level},
      {L, tTime, level}, {0, tTime, level}}, VertexTextureCoordinates →
      {{0, 0}, {1, 0}, {1, 1}, {0, 1}}]}, Lighting → {{"Ambient", White}}];

Show[listPlot, gr, PlotRange → {-.01, 0.21}, BoxRatios -> {1, 1, 1}]
(*Notice that the plot somewhat jagged on some
  of the contours starting to become unstable! for s = 0.50*)
```

Out[731]=