Quilt Plot for n - variable functions

Quilt plots

Quilt plots are plots that describe the small scale change of a function through linear approximations of the graph by small quadrilaterals.
In class we saw an `implementation of the quilt plot for 2-variable functions`.
We want to generalize this to n-dimensional functions.

Objective

Given an n-dimensional function F(x) and k<l<n, we want to find the quilt plot of the function with respect to x_k and x_l.

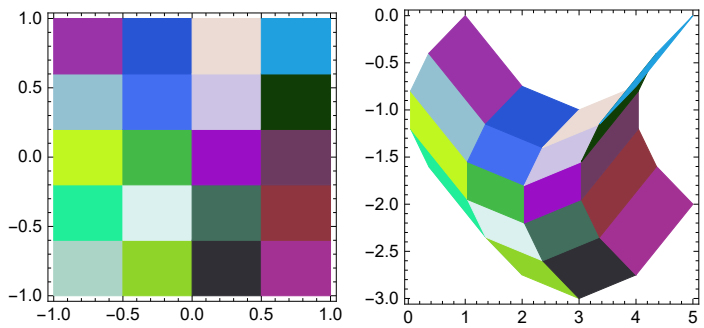
Implementation

We can generalize most parts of the program into n variables. When we construct the polygons, we take into consideration only the coordinates of the component functions we are interested in.

```
QuiltPlot[n_, k_, l_, F_List, X_List] := Module[{iX, grid, dX}, iX =
    Do[Sow[Evaluate[ToExpression["ix" <> ToString@i]]], {i, n}] // Reap // Last // Last;
   dX = Do[Sow[Evaluate[ToExpression["dx" <> ToString@i]]], {i, n}] // Reap // Last //
     Last;
   SeedRandom[1];
   indices =
    AppendTo[(UnitVector[n, k] + UnitVector[n, l]) /. {{1 → All, 0 → 1}} // Last, {k, l}];
   (*This is the index of the endpoints of the polygons*)
   Do[dX[[i]] = (X[[i, 3]] - X[[i, 2]]) / X[[i, 4]], {i, n}];
   grid =
    Table[Do[Sow[X[[i, 1]] → X[[i, 2]] + iX[[i]] * dX[[i]]], {i, n}] // Reap // Last // Last,
       ###] & @@ (Do[Sow[{iX[[i]], 0, X[[i, 4]]}], {i, n}] // Reap // Last // Last);
   grid = Map[(F /. #) &, grid, {2}];
   (*grid is the table of values x_i gets
     sent to at the small interval endpoints xmin_i+ix_i*dx_i*)
   polygoncoords = {{0, 0}, {0, 1}, {1, 1}, {1, 0}} + ConstantArray[iX[[{k, l}]], 4];
   t = Table[{RGBColor[Random[], Random[], Random[]],
        Polygon[(Indexed[Extract[grid, indices], #] & /@ polygoncoords)]}, ##] & @@
     Transpose[{iX[[{k, l}]], X[[{k, l}, 4]]}];
   (*This is the table of polygon endpoints, along with the random colors,
   for x_k vs x_l*)
   Show[Graphics[t], Frame → True, AspectRatio → 1]];
DoubleQuiltPlot[n_, k_, l_, F_List, X_List] :=
 GraphicsRow[{QuiltPlot[n, k, l, (# & @@@ X), X], QuiltPlot[n, k, l, F, X]}]
```

We can then find the quilt plot for say, a 4-variable function with respect to x_1 and x_4 as shown below.

```
DoubleQuiltPlot[4, 1, 4,
 {2 x1 - 3 x2 + x3 + x4^2, x1 + 2 x2 + x3 - x4, 5 x1 + x2 - x3^2 + x^4, x1^2 + x2 + x3 + x4},
 {{x1, -1, 1, 4}, {x2, -1, 1, 5}, {x3, -1, 1, 5}, {x4, -1, 1, 5}}]
```

Set: Tag Last in Last[{{All, 1, 1, All}}] is Protected.

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