

Catalan Numbers Poster

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ts[n_Integer] := ts[Range[0, n + 1]];
ts[{}, {}] = {ds[]};
ts[vs_List] :=
Module[{l, r, k, t1, t2, tds}, Union @@ Table[l = ts[Prepend[vs[[k ;;], vs[[1]]]];
  r = ts[vs[[2 ;; k]]];
  Flatten[Table[tds = Join[t1, t2];
    If[k > 3, AppendTo[tds, d[vs[[2]], vs[[k]]]];
    If[k < Length[vs], AppendTo[tds, d[vs[[1]], vs[[k]]]];
    tds, {t1, l}, {t2, r}], {k, 3, Length[vs]}]]

(*A function to create a picture of the triangulation*)
tspic[ls_] := Module[{l1, l2, n = Length[ls] + 1},
  l1 = List @@ Function[Line[{{#1, #2}}] @@@ ls /. j_Integer -> {Cos[ $\frac{2\pi j}{n+2}$ ], Sin[ $\frac{2\pi j}{n+2}$ ]}];
  l2 = Line[Range[0, n + 2] /. j_Integer -> {Cos[ $\frac{2\pi j}{n+2}$ ], Sin[ $\frac{2\pi j}{n+2}$ ]}];
  Graphics[Append[l1, l2]]
]

(*A function to create the charts from the triangulations. The output is a list of {0,1}
or {1,0} where {1,0} indicates one step right and {0,1} indicates one step up*)
chart[tri_] := Module[{tri1, a = {{1, 0}}, i = 0, n = Length[tri] + 1},
  tri1 = tri;
  While[Length[tri1] != 0,
    a = Nest[Function[Append[#, {1, 0}]], a, Count[tri1, d[i, _]]];
    tri1 = DeleteCases[tri1, d[i, _]];
    a = Append[a, {0, 1}];
    i++;
  ];
  a = Nest[Function[Append[#, {0, 1}]], a, 2 * n - Length[a]];
  a
];

(*A function to create the graphics of the chart from the chart list*)
chpic[list_] := Module[{start = {0, 0}, i = 1, output = {}, n = Length[list] / 2},
  While[i <= Length[list],
    output = Append[output, Line[{start, start + list[[i]]}]];
    start = Plus @@ list[[1 ;; i]];
    i++;
  ];
  Graphics[output, GridLines -> {Range[0, n], Range[0, n]},
  GridLinesStyle -> Directive[Gray, Dashed]]
]

Poster[n_Integer] := Grid[Table[{tspic[i], chpic[chart[i]]}, {i, ts[n]}], Frame -> All]

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Poster [5]





















