1 Moorish

These designs are largely taken from the chapter on Moorish tiling patterns in Owen Jones' *Grammar of Ornament*, 1856. The section names are all mine. Each file inputs `jones-colors.mp`, which defines the six colours used as follows:

```
ivory = 1/256 (218, 209, 199);
navy = 1/256 (57, 62, 81);
gold = 1/256 (213, 168, 101);
forest = 1/256 (68, 93, 105);
lapiz = 1/256 (45, 53, 166);
plum = 1/256(72, 59, 85);
```
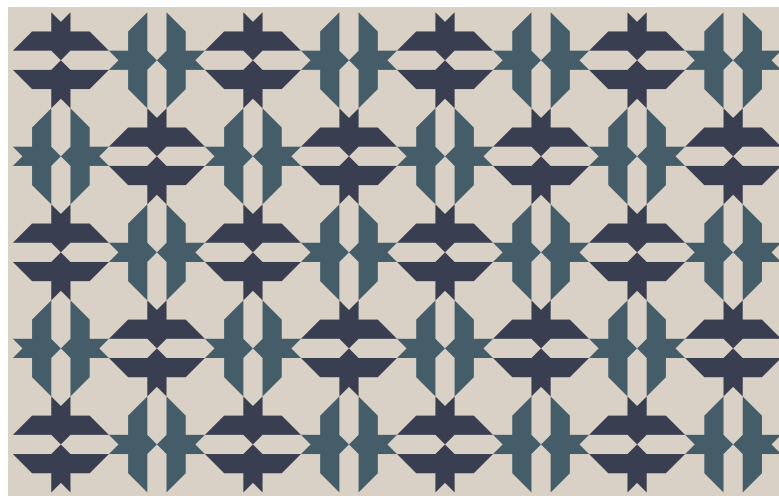
Bats


```
beginfig(1);
  path bat;
  bat = (0,0)--(1,1)--(5,1)--(3,3)--(1,3)--(1,5)--(0,4)--
        (-1,5)--(-1,3)--(-3,3)--(-5,1)--(-1,1)--cycle;
  vardef unit(expr shade) = image(for t=0, 180:
    fill bat scaled 3.6 rotated t withcolor shade;
  endfor) enddef;
  picture tile[]; tile0 = unit(navy); tile1 = unit(forest) rotated 90;
  numeric u, v; (u,v) = urcorner tile0 - llcorner tile0;
  for i=1 upto 8:
    for j=1 upto 5:
      draw tile[(i+j) mod 2] shifted (i*u,j*v);
    endfor
  endfor
  picture p; p = currentpicture; fill bbox p withcolor ivory; draw p;
endfig;
```

Carré
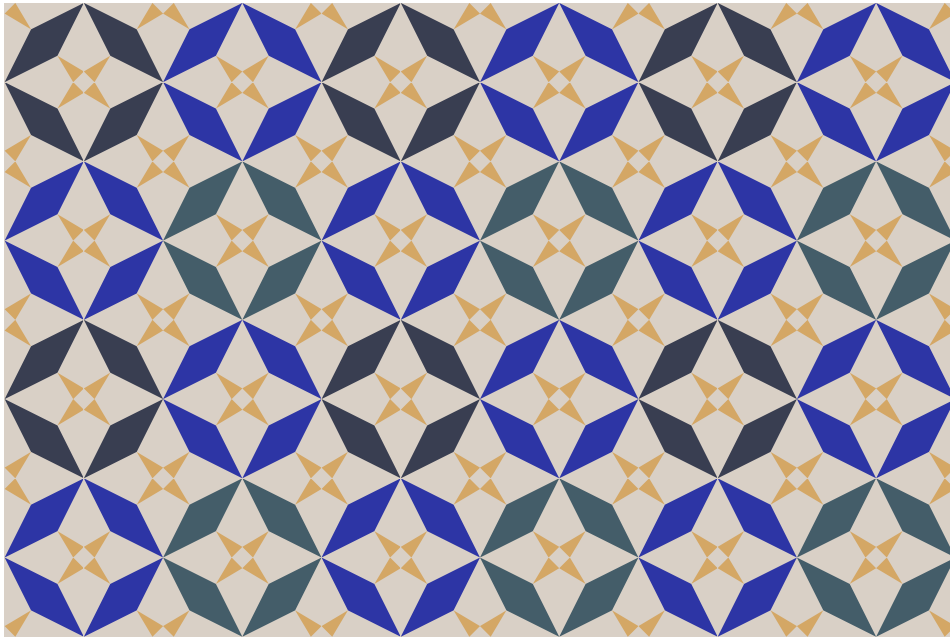

```
beginfig(1);
  path lozenge, triangle, box;
  lozenge = (left -- down -- right -- up -- cycle)
    yscaled 1/3 rotated -45 scaled 21;
  interim bboxmargin := 0; box = bbox lozenge;
  triangle = point 0 of box + 4 right -- point 1 of lozenge
         -- point 0 of box + 4 up -- cycle;

  vardef paint_tile(expr s) = image(
    fill box withcolor ivory;
    fill triangle withcolor gold;
    fill triangle rotated 180 withcolor gold;
    fill lozenge withcolor s;
  ) enddef;

  picture tile[];
  tile0 = paint_tile(lapiz);    tile2 = paint_tile(navy);
  tile1 = paint_tile(forest);  tile3 = paint_tile(lapiz);

  (u, v) = urcorner tile0 - llcorner tile0;
  for i = 0 upto 11:
    for j = 0 upto 7:
      t := (floor (i/2) mod 2) + 2(floor (j/2) mod 2);
      draw tile[t] if odd (i+j): rotated 90 fi shifted (i*u, j*v);
    endfor
  endfor
endfig;
```

Cross
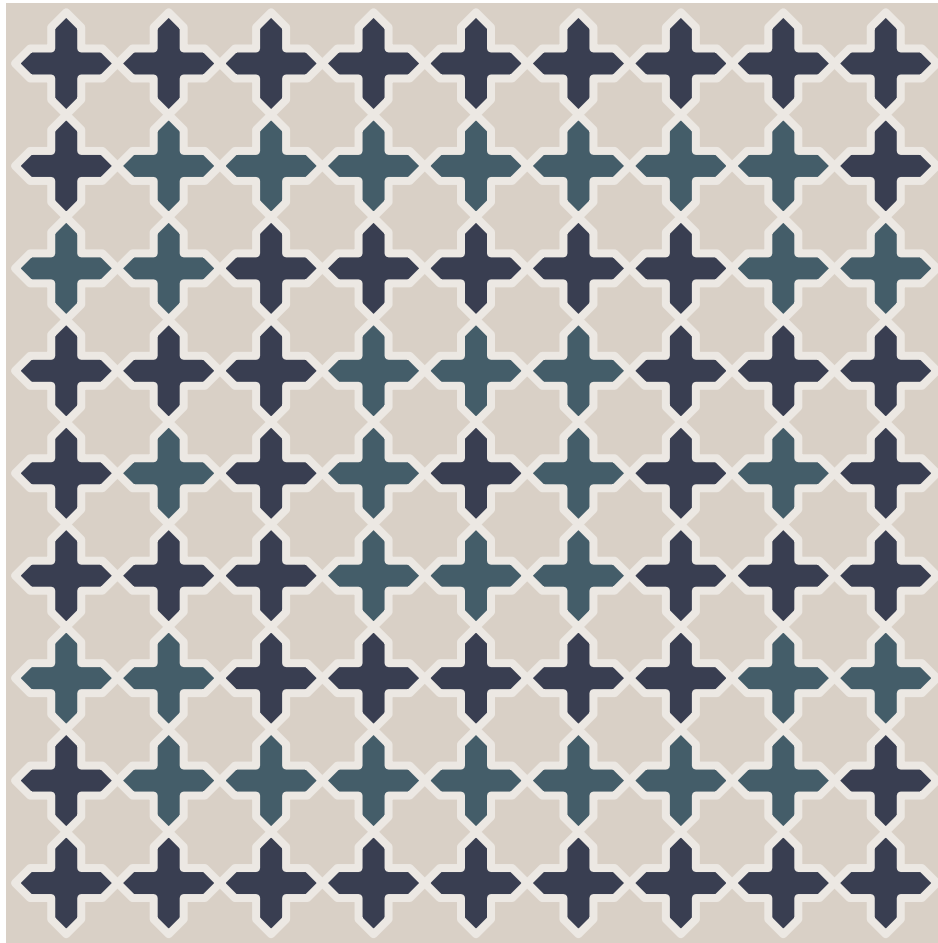

```
beginfig(1);
  path cross;
  numeric r, t; t = 2; r = t-sqrt(2);
  cross = (for i=0 upto 3:
    ((t,0) -- (t-r, r) -- (r, r) -- (r, t-r)) rotated 90i --
  endfor cycle) scaled 9.6;

  pair u, v;
  u = point 0 of cross - point 8 of cross;
  v = point 4 of cross - point 12 of cross;
  n = 4;
  for i=-n upto n:
    for j=-n upto n:
      k := j + floor ((i + abs(j)) / (2 abs(j) + 1));
      fill cross shifted (i*u+j*v)
        withcolor if odd k: forest else: navy fi;
      draw cross shifted (i*u+j*v)
        withpen pencircle scaled 3 withcolor 1/2[ivory, white];
    endfor
  endfor
  picture P; P = currentpicture; fill bbox P withcolor ivory; draw P;
endfig;
```

Hex-star
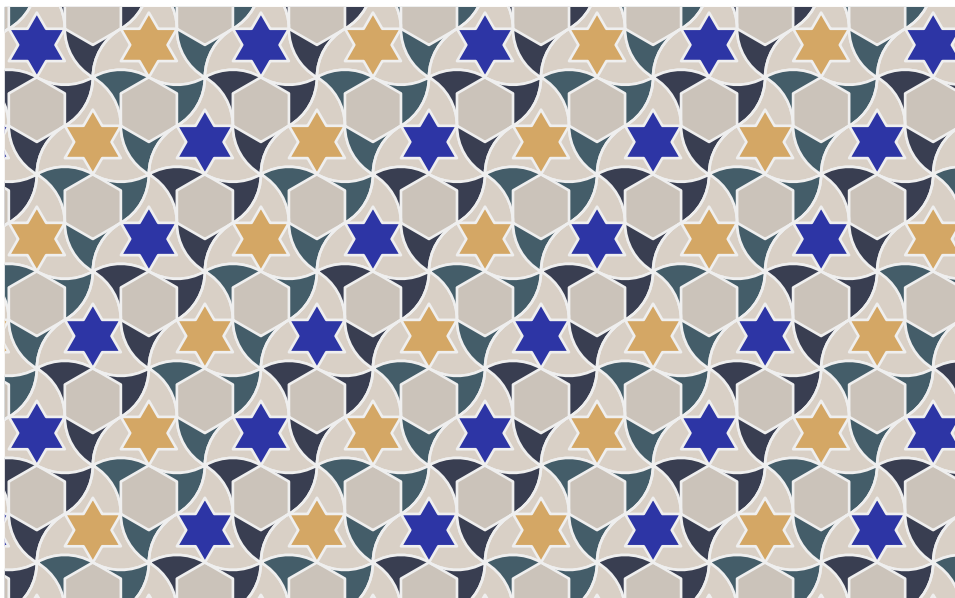

```
beginfig(1);
  numeric r; r = sqrt(1/3);
  path t; t = (r * dir   0 {dir  60} .. {dir 120} 2r * dir  60 {dir 240}
            .. r * dir 120 {dir 180} .. {dir 240} 2r * dir 180 {dir 360}
            .. r * dir 240 {dir 300} .. {dir 360} 2r * dir 300 {dir 120}
            .. cycle) rotated -30 scaled 21;
  numeric a; (a, whatever) = t intersectiontimes (origin -- infinity * up);
  path h; h = for i=0 upto 5: point a of t rotated 60i -- endfor cycle;
  path t'; t' = t rotatedabout(point 1 of t, 60);
  path h'; h' = h rotatedabout(point 1 of t, 60);
  path s; s = for i=0 upto 5:
    point i of h' -- 1/3[point i of h', point i+2 of h'] --
  endfor cycle;
  vardef unit(expr a, b) = image(
    fill t withcolor a; fill h withcolor 15/16 ivory;
    fill t' withcolor ivory; fill s withcolor b;
    drawoptions(withpen pencircle scaled 1 withcolor 15/16);
      draw t; draw t'; draw h; draw s;
    drawoptions();
  ) enddef;
  pair u, v; u = origin rotatedabout(point 1 of t, 120); v = u rotated -60;
  numeric n; n = 6;
  for i = -n upto n:
    for j = -n upto n:
      draw unit(if odd (i+j): navy else: forest fi,
        if odd (i+j): gold else: lapiz fi)
        shifted (i*u + j*v);
    endfor
  endfor
  clip currentpicture to unitsquare shifted -(1/2,1/2) scaled 5in yscaled 0.618;
endfig;
```
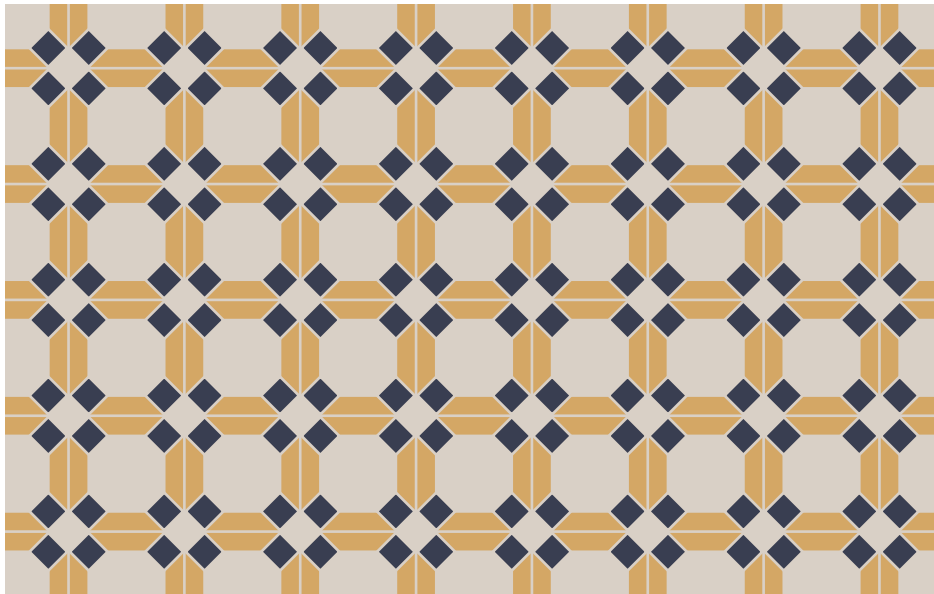
Lifebelt


```
beginfig(1);
  background := ivory;
  numeric u; u = 10;
  path s; s = unitsquare scaled u shifted 1/2(3u, -u) rotated 45;
  path t; t = subpath (2,3) of s -- subpath (0,1) of s rotated 90 -- cycle;
  picture unit; unit = image(
    pickup pencircle scaled 1;
    for i=0 upto 3:
      fill s rotated 90i withcolor navy;
      fill t rotated 90i withcolor gold;
    endfor
    for i=0 upto 3:
      undraw s rotated 90i;
      undraw subpath (1,2) of t rotated 90i;
    endfor
    pickup defaultpen;
  );
  numeric u, v; (u,v) = urcorner unit - llcorner unit;
  for i=0 upto 8:
    for j= 0 upto 5:
      draw unit shifted (i*u, j*v);
    endfor
  endfor
  picture P; P = currentpicture; unfill bbox P; draw P;
  begingroup;  interim bboxmargin := -1/2 u;
  clip currentpicture to bbox currentpicture;
  endgroup;
endfig;
```

Octa-star
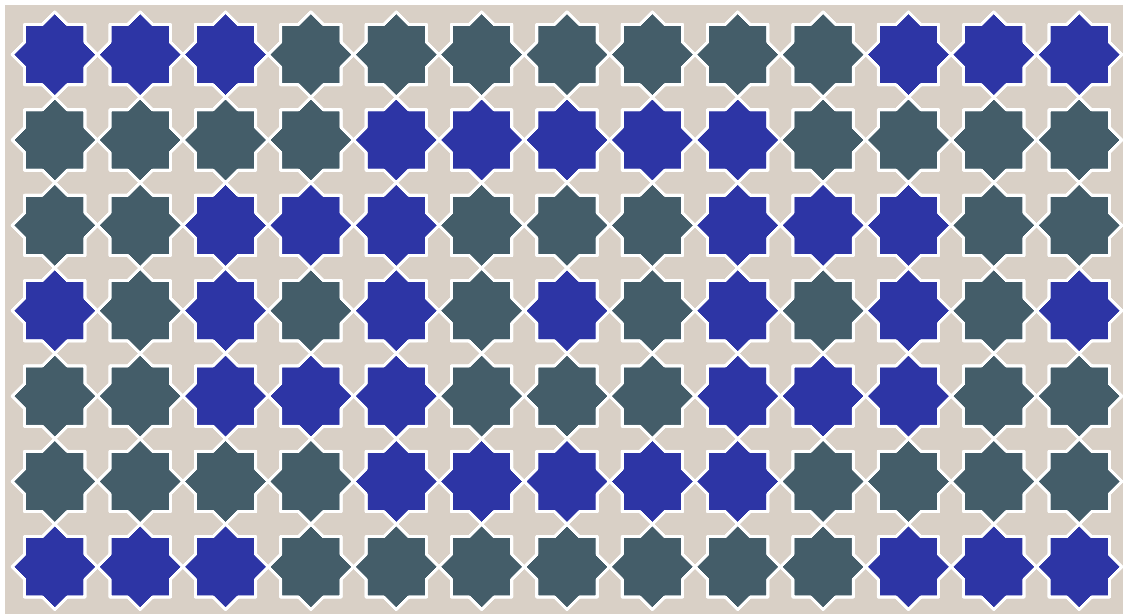

```
vardef star(expr n, s, r) =
  save a, b, t; path a, b; numeric t;
  a = (up -- up rotated (360/n*s)) scaled r;
  b = a rotated -(360/n*(s-1));
  (t,whatever) = a intersectiontimes b;
  for i=0 upto 2n-1: subpath (0, t) of a rotated (360/n*i) -- endfor cycle
enddef;

beginfig(1);
  background := ivory;
  path cross; cross = star(8,2,16);
  numeric u, v; (u, v) = urcorner cross - llcorner cross;
  for i=-6 upto 6:
    for j=-3 upto 3:
      pair z; z = (i*u, j*v);
      numeric k; k = j + floor ((i + abs j) / (1 + 2 abs j));
      fill cross shifted z withcolor if odd k: forest else: lapiz fi;
      draw cross shifted z withpen pencircle scaled 1 withcolor white;
    endfor
  endfor
  picture P; P = currentpicture; unfill bbox P; draw P;
endfig;
```

Quad
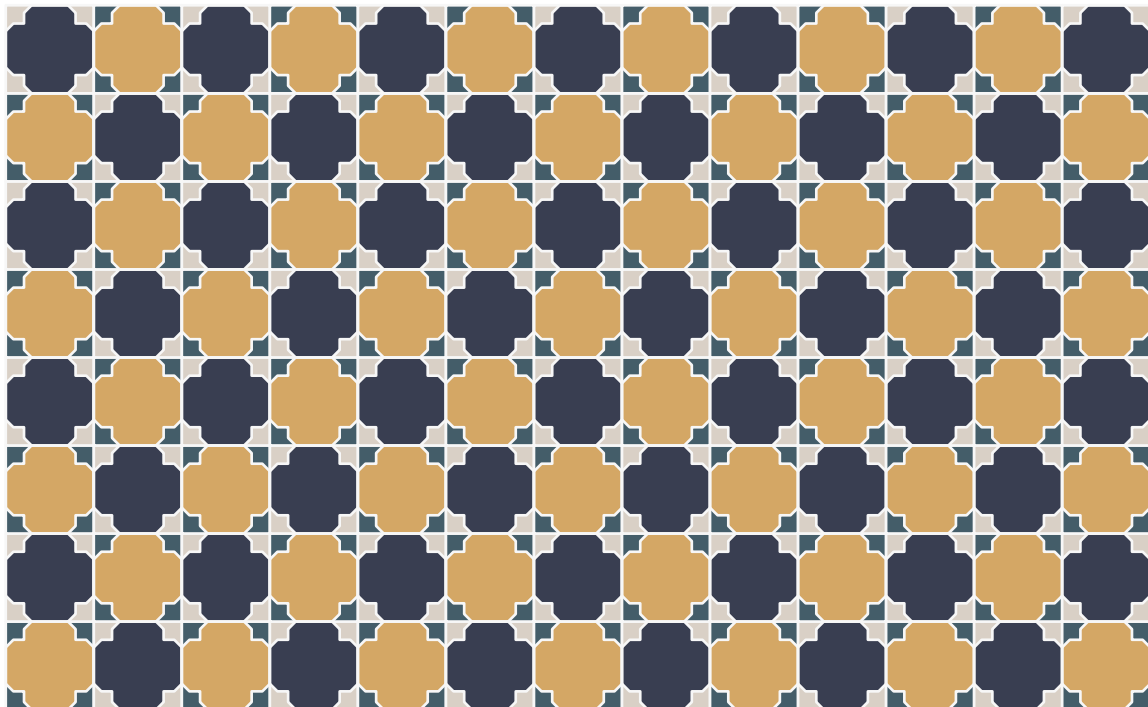

```
beginfig(1);
  numeric u, r; u = 33; r = sqrt(1/2);
  path s; s = unitsquare shifted -(1/2, 1/2) scaled u;
  path o; o = for i=0 upto 7: point r of s rotated 45i -- endfor cycle;
  path c; c = for i=0 upto 3:
    (subpath (0, 1-r) of o --
    point 0 of o rotatedabout(point 1 of s, -45) --
    subpath (r, 1) of o) rotated 90i --
  endfor cycle;

  vardef tile(expr fg, bg) = image(
    fill s withcolor bg;
    fill c withcolor fg;
    draw s withpen pencircle scaled 1 withcolor 31/32;
    draw c withpen pencircle scaled 1 withcolor 31/32;
  ) enddef;

  for i=1 upto 13:
    for j=1 upto 8:
      draw if odd (i+j):
        tile(navy, ivory)
      else:
        tile(gold, forest)
      fi shifted (i*u, j*u);
    endfor
  endfor
endfig;
```

Rosette
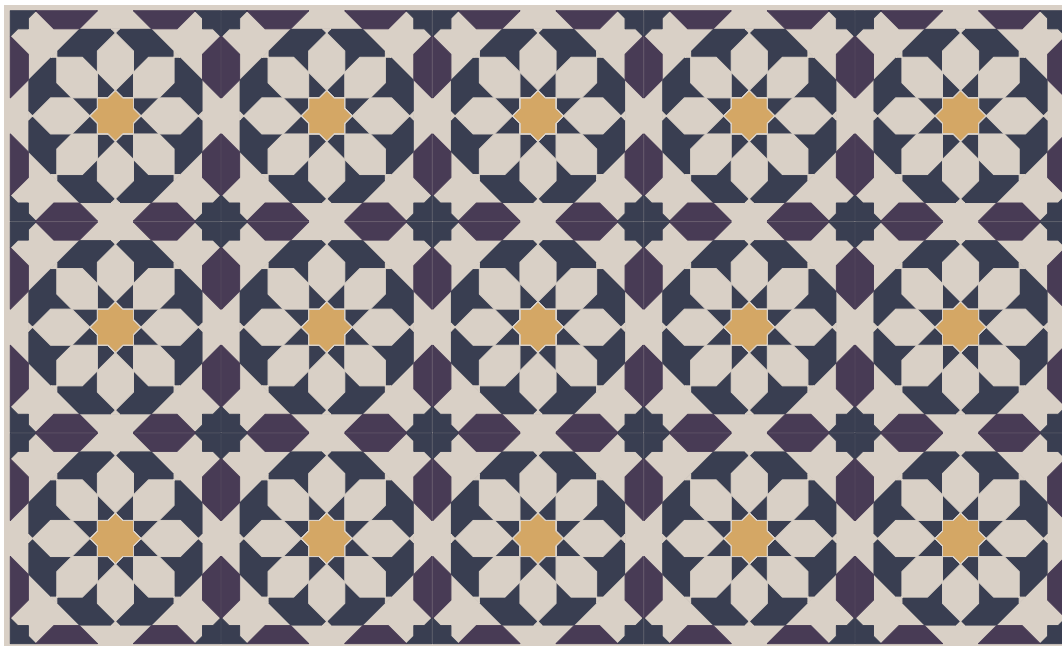

```
beginfig(1);
  background := ivory;
  path o; o = for i=0 upto 7: 48 dir (45i + 45/2) -- endfor cycle;
  fill o withcolor navy;
  numeric r, s; r = 3; s = 13; pair q; q = (s,s) scaled sqrt(1/2);
  path t; t = (up -- origin -- right) scaled s;
  path u; u = (down * s -- up * r -- right * r -- left * s);
  path leaf; leaf = t shifted q --
                    u shifted (point 1/2 of o - 1/2(r,r)) -- cycle;
  for i=0 upto 7:
    unfilldraw leaf rotated 45i withpen pencircle scaled 1/4;
  endfor
  path v; v = star(8,2,s); % same macro as "octa-star" uses
  fill v withcolor gold; undraw v;
  path w; w = (origin -- subpath(4,8) of v -- cycle)
              shifted (xpart point 0 of o, ypart point 1 of o) shifted q;
  path p; p = point 0 of o -- point 5 of w shifted (q rotated 180) --
              point 5 of w -- point 0 of o shifted (q rotated -90) -- cycle;
  for i=0 upto 3:
    filldraw w rotated 90i withcolor navy;
    filldraw p rotated 90i withcolor plum;
    filldraw p reflectedabout(left, right) rotated 90i withcolor plum;
  endfor

  picture unit; unit = currentpicture; clearit;
  numeric u, v; (u,v) = urcorner unit - llcorner unit;
  for i=1 upto 5: for j = 1 upto 3:
    draw unit shifted (i*u, j*v);
  endfor endfor
  picture P; P = currentpicture; clearit;
  P := P scaled (396 / xpart (urcorner P - llcorner P));
  unfill bbox P; draw P;
endfig;
```

Scotch
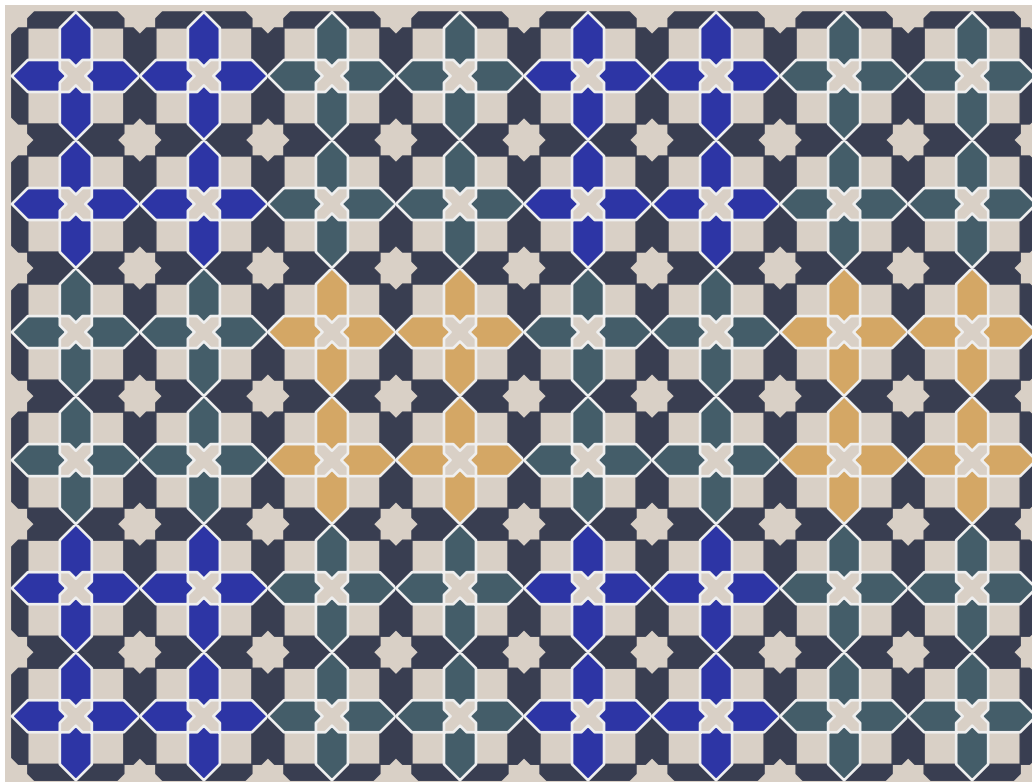

```
beginfig(1);
  background := ivory;
  numeric r; r = sqrt(2)-1;
  path s; s = (0, r-1) -- (r, -1) -- (1, -1) -- (1, -3) -- (0, -4);
  path t; t = (0, -4) -- (1, -3) -- (3, -3) -- (3, r-4) -- (3-r, -4);
  s := s -- subpath (3,1) of s reflectedabout(up, down) -- cycle;
  t := t -- subpath (4,1) of t reflectedabout(up, down) -- cycle;

  numeric u; 4u = 24;
  s := s scaled u;
  t := t scaled u;

  vardef unit(expr shade) = image(for i=0 upto 3:
    filldraw t rotated 90i withcolor navy;
    fill s rotated 90i withcolor shade;
    draw s rotated 90i withpen pencircle scaled 1 withcolor 15/16;
  endfor) enddef;

  for i=2 upto 9:
    for j=2 upto 7:
      color shade; shade =
      if odd floor(i/2): if odd floor(j/2): lapiz else: forest fi
                   else: if odd floor(j/2): forest else: gold fi fi;
      draw unit(shade) shifted ((i, j) scaled 8u);
    endfor
  endfor

  picture P; P = currentpicture;clearit; unfill bbox P; draw P;
endfig;
```