Is bumpy chiral? One picture of bumpy:





Small Rhombicosadodecahedron [On Big Bang Theory]

Great Rhombicosadodecahedron [rhombi]

Pictures from:

http://upload.wikimedia.org/wikipedia/commons/3/31/Small_rhombicosidodecahedron.png http://gnu.ist.utl.pt/software/3dldf/grtrhmb.html

Assignment #2 is available from the class web page.

A graph G is planar if it can be drawn on the plane with no crossing edges.





planar graph G



planar embedding of G

Used as a starting point to find nice pictures of non-planar graphs:



A graph showing normal relationships with lots of crossings in it.

Codeguru



The same graph optimized to show only one crossing in it. The relations are maintained as it is.

Map 4-colouring:







Linear time algorithms for embedding:





Hopcroft & Tarjan, '74

Booth and Lueker, '76



OPEN: Find a really simple O(n) or maybe O(n log n) algorithm.

Boyer & Myrvold, '01

Rotation Systems

G connected on an orientable surface:



a: b d c b: a c e c: a d f g b d: a e g f c e: b g d f: c d g

g: c f d e

g= (2 - n + m - f)/2

0 plane

1 torus

2

F0: (a, b)(b, c)(c, a)(a, b) F1: (a, d)(d, e)(e, b)(b, a)(a, d)



What is the rotation system for this graph?



What is the rotation system for this graph?



To walk the faces from a rotation system:

Treat each edge as two arcs: $(u,v) \rightarrow (u, v)$ and (v,u).

Mark all arcs as not visited.

For each unvisited arc (u,v) do: walk the face with (u, v).

To walk the face with (u,v):

Arcs traversed are marked as visited.

The next arc to choose after an arc (u,v) is the arc (v,w) such that w is the vertex in the list of neighbours of v that comes after u in cyclic order.

Continue traversing arcs until returning to arc (u,v).

Walk the faces of this planar embedding of a graph:

This graph has 4 faces.





Important: Do not stop until seeing the starting ARC again. It's possible to have both (u,v) and (v,u) on the same face.