Chapter 2 Notes

1. Timeline of Knot Tabulation

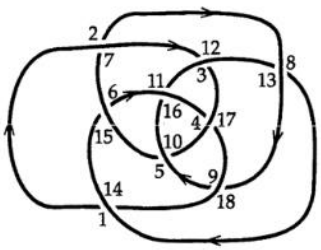
19th Century:

Early interests	Vortex atom theory	1st work on tabulation	1st successful tabulation	1st table of 43 nonalternating knots of 10 crossings
(early 19th century)	(1870s)	(1880s)	(1885)	(1890s)
Carl Friedrich Gauss	Lord Kelvin	Thomas P. Kirkman	Peter Guthrie Tait	C. N. Little

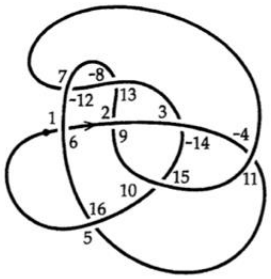
20th Century:

All amphicheiral knots of 12 crossings	Classify knots up to 9 crossings	Conway notation	Perko pair	1st list of prime knots through 11 crossings	Dowker notation	Table of prime knots up to 16 crossings by computer
(1917)	(1927-1932)	(1969)	(1974)	(1978)	(1983)	(1998)
Mary G. Haseman	Alexander Kurt Reidemeister	John H. Conway	Kenneth A Perko	Alain Caudron	Hugh Dowker	Morwen Thistlewaite Jim Hoste & Jeff Weeks

2. Dowker Notation



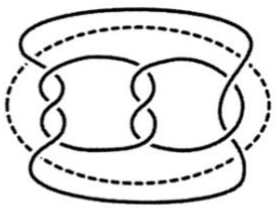
1	3	5	7	9	11	13	15	17
14	12	10	2	18	16	8	6	4



6 -14 16 -12 2 -4 -8 10

(1) Number of even integers = Number of crossings
(2) Even and odd integers are paired up
(3) For non-alternating knots, add + and – signs
    - if the even integer is assigned to the crossing on the understrand, make it negative

3. Conway Notation



The knot 8_5 has Conway notation 3, 3, 2.

The continued fraction corresponding to 3 −2 3 is

$$3 + \frac{1}{-2 + (1/3)}$$

(1) **Tangles**: a region in the projection plane surrounded by a circle such that the knot or link crosses the circle exactly four times in directions NW, NE, SW, SE
(2) **Equivalent tangles**: 2 tangles are the same if the components within the circle can be transformed from one to the other via Reidemeister moves. Equivalent tangles have the same continued fraction
(3) **Rational tangle**: 2-tangle that can be unwound into one of the two elementary 2-tangles by twisting the endpoints (See Untangling Your Square Dance for more). If represented by an even number of integers, the construction starts with 2 vertical strings (∞ tangle). If represented by an odd number of integers, the construction starts with 2 horizontal strings (0 tangle)
(4) **Continued fraction**: first number in denominator with numerator 1, add to the next number, all together in a denominator, add the next number, etc.
(5) **Rational link**: closing off the ends of a rational tangle
(6) **Algebraic tangle**: obtained by operations of addition and multiplication on rational tangles
(7) **Mutation**: cut, flip, glue back

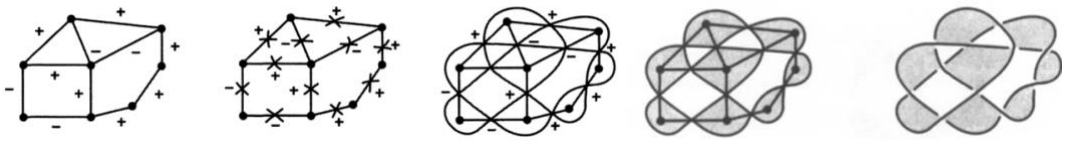
4. Planar Graphs

(1) A notation for knot projection
(2) Bridge between knot theory and graph theory
(3) Knot projection -> signed planar graphs:

A signed planar graph from a knot projection.

   a. Shade every other region of the projection
   b. Connect the center of shaded regions
   c. Label each edge in the planar graph with + or –

(4) Signed planar graphs -> knot projection:



   a. Put an x across each edge
   b. Connect the edges inside each region
   c. Shade the areas that contain a vertex
   d. Put a crossing according to the sign on the edge