4.13 Gamow's Diamonds

One codon determines the other one so we consider the different possibilities for one codon

there are 3 slots with 4 possibilities for each $4^3 = 64$ possible codons

We consider 3 different cases

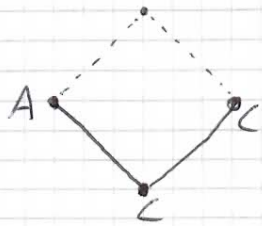
3 equal elements

there are 4 different possibilities for what the equal element are
So 4 different possibilities with a total 4 representations

2 equal elements

We use 2A 1C as our example

3 possible codons ACC, CAC, CCA

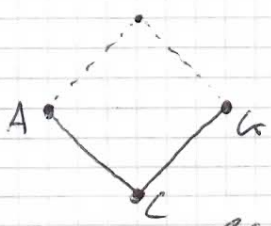


A counter clockwise gives ACC
Bottom C clockwise gives CAC
Right C clockwise gives CCA

each codon has 3 identical representations
There are 12 unique codons (2A1T, 2A1G, 2A1C. 3 for each double
4 possibilities for the double $3 \times 4 = 12$)
So 12 different possibilities with a total $12 \times 3 = 36$ representations

No equal elements

We use ACG as our example
There are 6 possible codons ACG, AGC, GAC, GCA, CGA, CAG



ACG A G AGC A C
GAC G G GCA G C
CGA C G CAG C C

each codon has 6 ~~identical~~ equivalent representations
There are 4 unique codons (ATC, ATG, AGC, TGC)
So 4 different possibilities with a total of $4 \times 6 = 24$ representations