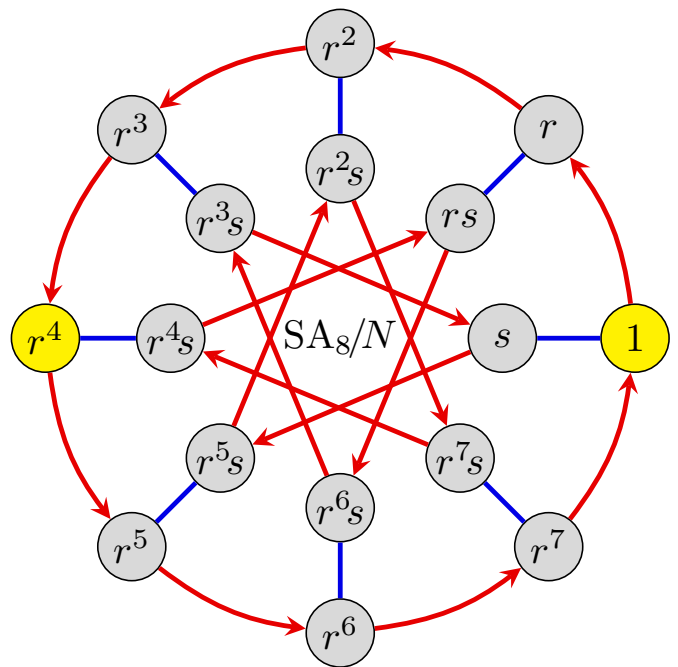
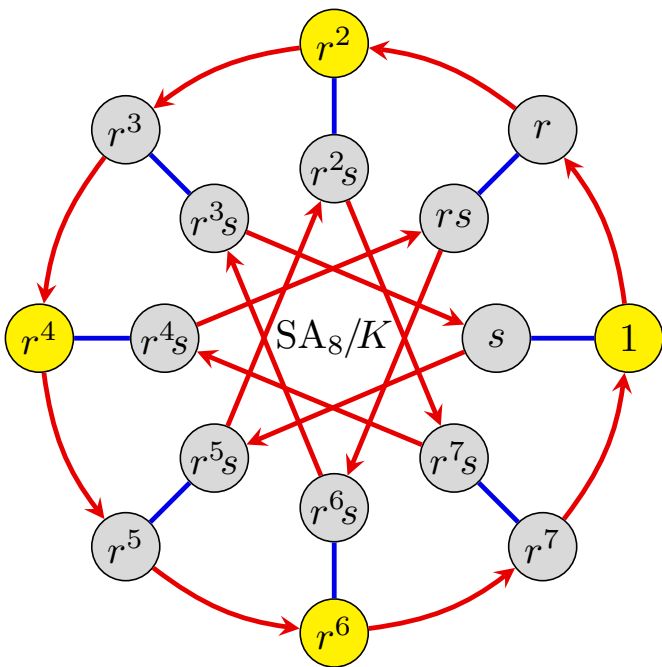
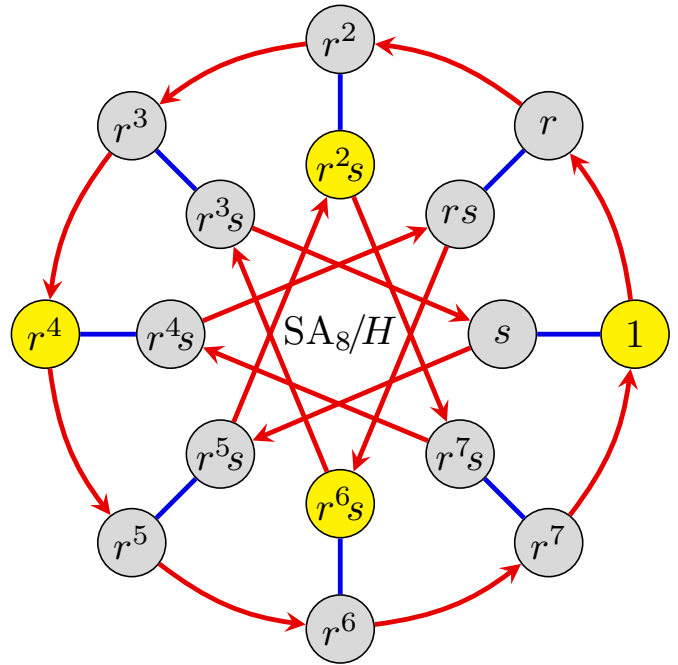
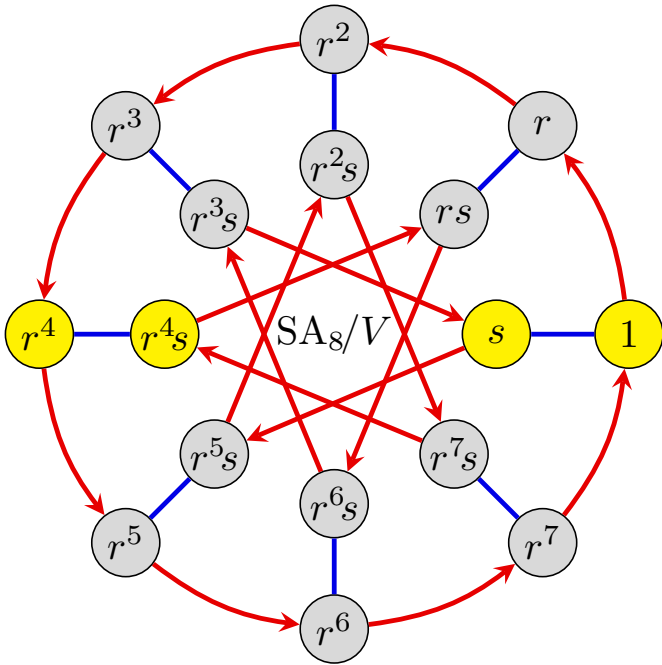


Scratch paper for Math 8510, HW 3

#2(a): Partitions of the *semiabelian group* SA_8 by cosets of the subgroups $V = \langle r^4, s \rangle$, $H = \langle r^2s \rangle$, $K = \langle r^2 \rangle$, and $N = \langle r^4 \rangle$.



#2(b): Cayley tables of the quotients of SA_8 by its subgroups $V = \langle r^4, s \rangle$, $H = \langle r^2s \rangle$, and $K = \langle r^2 \rangle$.

	V
V	

	H
H	

	K
K	

#2(c): “Shoebox diagrams” of the nontrivial proper subgroups of SA_8/N , other than $\langle N \rangle \cong \{e\}$, $\langle rN, sN \rangle \cong SA_8/N$, and $\langle rN \rangle \cong C_4$ (already done).

r^3N	r^3sN
r^2N	r^2sN
rN	rsN
N	sN

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3N	r^3sN
r^2N	r^2sN
rN	rsN
N	sN

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3N	r^3sN
r^2N	r^2sN
rN	rsN
N	sN

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3N	r^3sN
r^2N	r^2sN
rN	rsN
N	sN

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3N	r^3sN
r^2N	r^2sN
rN	rsN
N	sN

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

#2(d): Shoebox diagrams of subgroups of SA_8/V , where $V = \langle r^4, s \rangle$.

r^3V
r^2V
rV
V

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3V
r^2V
rV
V

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3V
r^2V
rV
V

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

r^3	r^7	r^3s	r^7s
r^2	r^6	r^2s	r^6s
r	r^5	rs	r^5s
1	r^4	s	r^4s

#1(d): Shoebox diagrams of subgroups of SA_8/H , where $H = \langle r^2s \rangle$.

r^3H
r^2H
rH
H

r^3	r^5s	r^7	rs
r^2	r^4s	r^6	s
r	r^3s	r^5	r^7s
1	r^2s	r^4	r^6s

r^3	r^5s	r^7	rs
r^2	r^4s	r^6	s
r	r^3s	r^5	r^7s
1	r^2s	r^4	r^6s

r^3H
r^2H
rH
H

r^3	r^5s	r^7	rs
r^2	r^4s	r^6	s
r	r^3s	r^5	r^7s
1	r^2s	r^4	r^6s

r^3	r^5s	r^7	rs
r^2	r^4s	r^6	s
r	r^3s	r^5	r^7s
1	r^2s	r^4	r^6s

r^3H
r^2H
rH
H

r^3	r^5s	r^7	rs
r^2	r^4s	r^6	s
r	r^3s	r^5	r^7s
1	r^2s	r^4	r^6s

r^3	r^5s	r^7	rs
r^2	r^4s	r^6	s
r	r^3s	r^5	r^7s
1	r^2s	r^4	r^6s

#1(d): Shoebox diagrams of subgroups of SA_8/K , where $K = \langle r^2 \rangle$.

rsK
sK
rK
K

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

rsK
sK
rK
K

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

rsK
sK
rK
K

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

rsK
sK
rK
K

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

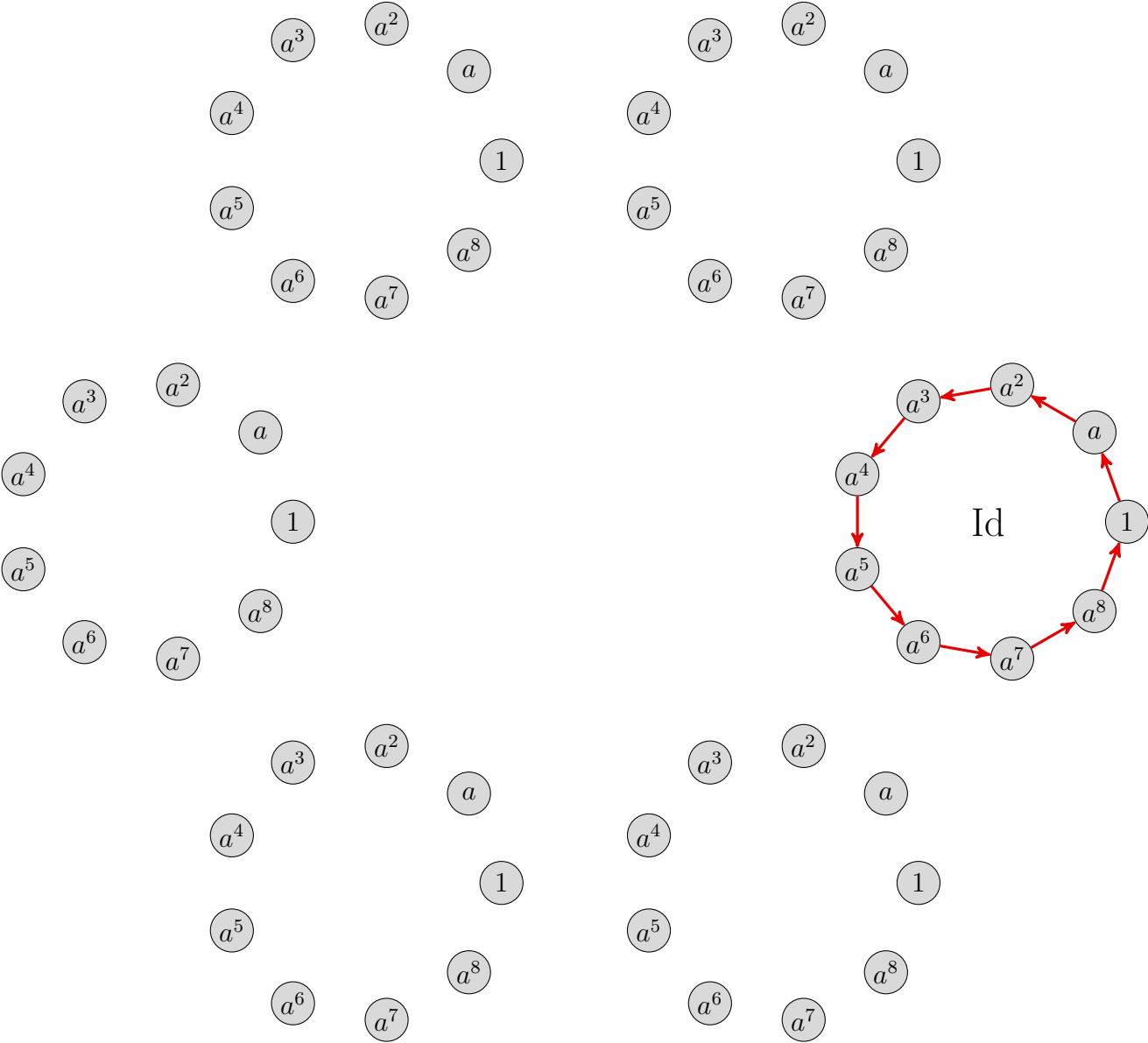
rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

rsK
sK
rK
K

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

rs	r^3s	r^5s	r^7s
s	r^2s	r^4s	r^6s
r	r^3	r^5	r^7
1	r^2	r^4	r^6

#5: Cayley graph of $\text{Aut}(C_9)$, the *automorphism group* of C_9 , which is isomorphic to $U_9 = \{1, 2, 4, 5, 7, 8\}$, the multiplicative group of integers modulo 9. The nodes are labeled by rewirings (automorphisms) of the Cayley diagram.



#5: Cayley graph of $C_9 \times C_3 = \langle a, b \rangle = \{a^i b^j \mid 0 \leq i \leq 8, 0 \leq j \leq 2\}$.

