**First day:**

1. Using
$$if_{abc} = 2\mathrm{Tr}\left(t^c[t^a, t^b]\right) \tag{1}$$
show that $f_{abc}$ is anti-symmetric with respect to any pair of indices.

2. Prove the Fierz identity
$$\delta^i_j \delta^l_k = \frac{1}{N}\delta^i_k \delta^l_j + 2(t^a)^i_k (t^a)^l_j \tag{2}$$

3. Use the Fierz identity to derive the Casimirs $C_F$ and $C_A$.

4. Show that
$$t^a t^b t^a = -\frac{1}{2N} t^b \tag{3}$$
and draw the corresponding colour diagram.

5. Simplify
$$if_{abc} t^a t^c \tag{4}$$
and draw the corresponding colour diagram.

6. Prove the following identity
$$\left[t^a, [t^b, t^c]\right] + \left[t^b, [t^c, t^a]\right] + \left[t^c, [t^a, t^b]\right] = 0. \tag{5}$$
Use now the above identity to prove the Jakobi identity
$$f_{abe} f_{cde} + f_{bce} f_{ade} + f_{cae} f_{bde} = 0 \tag{6}$$

7. Visualize the Jakobi identity using color diagrams.

8. Produce a $q\bar{q}$ pair via a vector current. Check that coherent radiation off the $q$ and $\bar{q}$ cancels when $q\bar{q}$ are produced by a colour singlet source (photon $\to q\bar{q}$) and adds up into radiation off a gluon in the case of a $g \to q\bar{q}$ splitting process.