to $u_1^{n+1} = u_2^{n+1}$ and hence to $\omega^{n+1} = 1$, where $u_1 = u_2\omega$, which holds if and only if $(\exists u_2)$ $u_2^2\omega = 1$ and $u_2(1+\omega) = c$. Therefore $(1+\omega)^2 = c^2\omega$, so

$$2 + \omega + \bar{\omega} = (1 - \varepsilon - \bar{\varepsilon})^2.$$

Now if $\omega = \cos\frac{2k\pi}{n+1} + i\sin\frac{2k\pi}{n+1}$ and $\varepsilon = \cos\frac{2l\pi}{m} + i\sin\frac{2l\pi}{m}$, the above equality becomes the desired one.