1. Neutral meson P^0 and its antiparticle $\overline{P^0}$ decays to the same final state f. Calculate:

   a) the decay rates

   $$\Gamma_f = |\langle f|H|P^0(t)\rangle|^2 \text{ and } \bar{\Gamma}_f = \left|\langle f|H|\overline{P^0}(t)\rangle\right|^2$$

   b) the CP asymmetry of the form:

   $$a_{CP}(t) = \frac{\Gamma_f - \bar{\Gamma}_f}{\Gamma_f + \bar{\Gamma}_f}$$

2. Show that CP asymmetry for the channel $B^0 \to J/\psi K_S$ ("golden channel") can be used to extract unitary angle β. Start with the asymmetry:

   $$a_{CP}(t) = \frac{\Gamma(B^0 \to J/\psi K_S) - \Gamma(\overline{B^0} \to J/\psi K_S)}{\Gamma(B^0 \to J/\psi K_S) + \Gamma(\overline{B^0} \to J/\psi K_S)}$$

3. Write the equation describing the direct CPV in charged B-meson decay, for example $B^0 \to K^+\pi^-$.

4. Determine the sensitivity of CKM γ angle measurement in $B^0 \to D^0 K^{*0}$ decay.