13.1 Contribution to the vacuum energy density from SSB.

Calculate the difference in the vacuum energy density before and after SSB in the SM using v = 256 GeV and $m_h^2 = (125)^2 \text{ GeV}^2$. Compare this to the observed value of the cosmological constant. If you know GR: How does this affect the evolution of the Universe?

Numerically, $\rho = \lambda v^4/4 \sim 6 \times 10^{43} \text{ eV}^4$ is ~ 51 orders larger than ρ_{Λ} observed today. We can choose $\rho = 0$ either before or after SSB at the time t^* by shifting the potential up or down. In the first case, $\rho(>t^*) < 0$, corresponding to a negative cosmological constant Λ , and the universe will collapse.

In the second case, $\rho(\langle t^*) \rangle = 0$ and there will be a short phase of inflation before the EWSB. If this harmless or harmfull is not obvious without more detailed calculations. Note however that there will be at least one more contribution to ρ_{Λ} : $\rho_{\rm QCD}$ by a non-zero gluon condensate after $T \sim \Lambda_{\rm QCD}$. Thus we should end up again with option 1.