(4.7) One may assume that when $^{238}U$ was formed at the genesis an equal amount of $^{235}U$ was formed. Today the amount of $^{238}U$ is 138 times the amount of $^{235}U$. How long time ago did the genesis occur according to this assumption?

Half-lives from Fig. 5.1, p. 100-101:

$t_{235} := 7.038 \cdot 10^8 \cdot yr \qquad t_{238} := 4.468 \cdot 10^9 \cdot yr$

$\lambda_{235} := \frac{ln(2)}{t_{235}} \qquad \lambda_{238} := \frac{ln(2)}{t_{238}}$ Eqn. (4.43)

Eqn. (4.41a) gives:

$N_{235} = N_{0235} \cdot e^{-\lambda_{235} \cdot t}$ and $N_{238} = N_{0238} \cdot e^{-\lambda_{238} \cdot t}$ hence: $\frac{N_{238}}{N_{235}} = \frac{N_{0238}}{N_{0235}} \cdot \frac{e^{-\lambda_{238} \cdot t}}{e^{-\lambda_{235} \cdot t}}$

but we know that: $\frac{N_{238}}{N_{235}} = \frac{138}{1}$ and assume that $\frac{N_{0238}}{N_{0235}} = 1$

Using these data we get:

$\frac{138}{1} = \frac{1}{1} \cdot \frac{e^{-\lambda_{238} \cdot t}}{e^{-\lambda_{235} \cdot t}}$ or $138 = e^{t \cdot (\lambda_{235} - \lambda_{238})}$

$t := \frac{ln(138)}{(\lambda_{235} - \lambda_{238})} \qquad t = 1.874 \cdot 10^{17} \cdot sec \qquad t = 5.938 \cdot 10^9 \cdot yr$ ago