1. Let $X$ and $Y$ be topological spaces. Prove that

$$\pi_1(X \times Y, (x_0, y_0)) = \pi_1(X, x_0) \times \pi_1(Y, y_0).$$

2. Derive the fundamental group of $T_g$, the genus-$g$ Riemann surface. Hint: use the result of problem 3 in the third problem set.

3. Exercise 4.7 on p. 147 of Nakahara.

4. Exercise 4.8 on p. 147 of Nakahara.

5. Exercise 4.9 on p. 160 of Nakahara.