1. Compute

$$5^{2005} \ (\mathrm{mod} \ 23)$$

using the repeated squaring method.

2. Suppose it is known that the number n is a product of two distinct primes.

   (i) Suppose $\phi(n)$ is also known. Explain how one can quickly factor n.

   (ii) Let k be an integer such that $k \equiv 1 \ (\mathrm{mod} \ \phi(n))$. Show that

$$a^k \equiv a \ (\mathrm{mod} \ n)$$

for ALL integers a.

3. Exercise 15.2.1 in Biggs (contains a picture, so I don't describe the exercise here).

4. Let G be any graph. Show that either G or its' complement must be connected.