2.17) If $q \ll N$,

$$\Omega(N,q) = \binom{N+q-1}{q} \approx \binom{N+q}{q} = \binom{N+q}{N}$$

$$= \frac{(N+q)^{(N+q)}}{q^q \, N^N}$$

$$\ln \Omega = (N+q)\ln(N+q) - q\ln(q) - N\ln(N)$$

Now we approximate $\ln(N+q)$ by

$$\ln(N+q) \approx \ln N\left(1+\frac{q}{N}\right) \cong \ln N + \frac{q}{N}.$$

Thus, $\ln \Omega \approx (N+q)\left(\ln N + \frac{q}{N}\right) - q\ln(q) - N\ln(N)$

$$\cong q\ln N - q\ln q + q$$

where we neglected $\frac{q^2}{N} = q\left(\frac{q}{N}\right)$ relative to q and the even larger $q\ln(N/q)$ in the last step.

Thus, $\Omega(N,q) \approx \exp\left\{q\ln\left(\frac{N}{q}\right) + q\ln e\right\} = \left(\frac{Ne}{q}\right)^q$.