Exercise 2.3: (a) There would be two possibilities for each coin so 2^{50} microstates.

(b) There are $\frac{50!}{25!}$ ways of choosing witch 25 coins will be heads, however the order that we choose those coins in does not matter and so we need to eliminate the 25! overcounting and we see that there are $\frac{50!}{25!25!}$.

(c) $\frac{50!}{25!25!2^{50}} \approx 11.2\%$

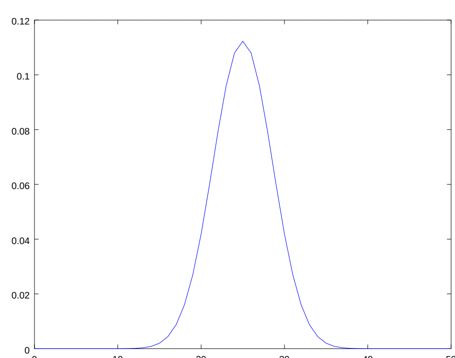
(d) $\frac{50!}{30!20!2^{50}} \approx 4.1\%$

(e) $\frac{50!}{40!10!2^{50}} \approx 0.00091\%$

(f) 2^{-50}

(g) in octave

```
>> x=[0:50];
>> p=factorial(50)./(factorial(x).*factorial(50-x).*2^50);
>> plot(x,p)
>> warning: print.m: epstool binary is not available.
Some output formats are not available.
warning: called from
    __print_parse_opts__ at line 382 column 9
    print at line 291 column 8
warning: print.m: fig2dev binary is not available.
Some output formats are not available.
diary off
```



Exercise 2.17: $\ln(\Omega(N,q)) \approx (q+N)\ln(q+N) - q\ln(q) - N\ln(N)$(2.18), Note that this equation is symetric under exchange of N and q. Thus since we already have a approximation when $q >> N$ we can by symetry simply swap N and q to obtain $\Omega(N,q) \approx e^{q\ln(N/q)}e^q = \left(\frac{eN}{q}\right)^q$ when $N >> q$. Basically do all of the steps 2.19-2.21 with N and q exchanged and you get the previous result.

Exercise 2.18: $\Omega(N,q) = \frac{(q+N-1)!}{q!(N-1)!} = \frac{N(q+N)!}{(q+N)q!N!}$, since $(A-1)! = \frac{A(A-1)!}{A} = \frac{A!}{A}$. Applying Sterling's approximation of $A! = (A)^A e^{-A}\sqrt{2\pi A}$ we get

$$\Omega(N,q) = \frac{N(q+N)!}{(q+N)q!N!} \approx \frac{N(q+N)^{q+N}e^{-(q+N)}\sqrt{2\pi(q+N)}}{(q+N)q^q e^{-q}\sqrt{2\pi q}N^N e^{-N}\sqrt{2\pi N}}$$

$$= \frac{N(q+N)^{q+N}e^{-(q+N)}\sqrt{(q+N)}}{(q+N)q^q e^{-q}N^N e^{-N}\sqrt{2\pi qN}}$$

$$= \frac{N(q+N)^{q+N}\sqrt{(q+N)}}{(q+N)q^q N^N\sqrt{2\pi qN}}$$

$$= \frac{N(q+N)^{q+N}}{\sqrt{(q+N)}q^q N^N\sqrt{2\pi qN}}$$

$$= \frac{(q+N)^{q+N}}{q^q N^N\sqrt{2\pi q(q+N)/N}}$$

$$= \frac{(q+N)^q(q+N)^N}{q^q N^N\sqrt{2\pi q(q+N)/N}}$$

$$= \frac{\left(\frac{q+N}{q}\right)^q\left(\frac{q+N}{N}\right)^N}{\sqrt{2\pi q(q+N)/N}}$$