1. Prove or refute: An encryption scheme with message space $M$ is perfectly secret if and only if for every probability distribution over $M$ and every $c_0, c_1 \in C$ we have $Pr[C = c_0] = Pr[C = c_1]$. False. Given encryption scheme $(Gen, Enc, Dec)$, construct scheme $(Gen, Enc', Dec')$. This is exactly the same except $Enc$ appends a 0 to its output with prob $1/4$ and a 1 with prob $3/4$. $Dec'$ ignores the final bit. Note that if $(Gen, Enc, Dec)$ is perfectly secret, so is $(Gen, Enc', Dec')$. But now choose any $c \in C$ (when $C$ is ciphertext space of $(Gen, Enc, Dec)$). Then we have $Pr[C = c \mid 0] < Pr[C = c \mid 1].$

2. Prove or refute: An encryption scheme with message space $M$ is perfectly secret if and only if for every probability distribution over $M$, every $m, m' \in M$ and every $c \in C$ we have $Pr[M = m \mid C = c] = Pr[M = m' \mid C = c]$. False. Given any perfectly secret encryption scheme, we will choose a distribution over $\Omega$, and $m, m', c$ s.t. $Pr[M = m \mid C = c] \neq Pr[M = m' \mid C = c]$. This refutes the above. Let's choose a distribution over $\Omega$ that sets $Pr[M = m] > Pr[M = m']$ for some $m, m'$. Now by Def 1 of perfect secrecy, $\forall c$ $Pr[M = m \mid C = c] = Pr[M = m]$ and $Pr[M = m' \mid C = c] = Pr[M = m']$. So $Pr[M = m \mid C = c] < Pr[M = m] = Pr[M = m' \mid C = c]$. So $Pr[M = m \mid C = c] \neq Pr[M = m' \mid C = c]$. 