Exercises chapter 11

1. (a) **A mean constraint.** Derive the maximum entropy distribution for a non-negative integer quantity n subject to knowledge of its mean value $\langle n \rangle$. Do the entire calculation using the method of Lagrange multipliers, then check that your solution conforms to the general solution presented in Chapter 11. Also calculate the value of the entropy for a mean value of 40 and 1000. Does the change in entropy make sense if you interpret entropy as "amount of uncertainty"?

   (b) **Bonus calculation.** You are a car salesman who sells on average 100 cars per year. (You are also a bit absentminded so you don't know any other details about your sales record, such as variations, etc.) Your boss suggests a change in your salary. Currently, your salary is 200000 SEK annually plus one thousand SEK per sold car. His suggestion is that you get 270000 SEK annually, and an additional 60000 SEK if you sell more than 100 cars. Otherwise, you get no bonus.

   Should you accept the offer?

2. **Is an assumption about independence consistent with the MaxEnt principle?** Consider two sets of propositions, $X = \{X_1, ..., X_{nx}\}$ and $Y = \{Y_1, ..., Y_{ny}\}$. Suppose that we know the marginal distributions $P(X_i|I) = Q_i$ and $P(Y_j|I) = R_j$. Show that the MaxEnt distribution for $P(X, Y|I)$ then is given by the product $P(X_i, Y_j|I) = Q_i R_j$.