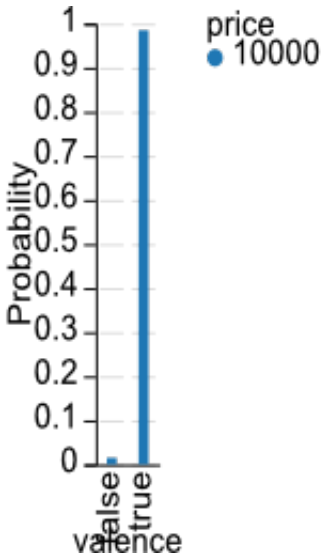
Solutions for selected exercises of Chapter 3

1. **Exercise on prior:** Use `Infer()` to visualize the joint distribution on price and valence. (Hint: You'll want to run inference over a function that returns an object like the following: `{price: aPrice, valence: aValence}`.)

```
Infer(function(){
  var price = pricePrior()
  var valence = valencePrior(price)
  return {price, valence}
})
```

2. **Exercises on literal listener:**
   I. Suppose the literal listener hears the kettle costs 10000 dollars with the "priceValence" QUD. What does it infer?

```
literalListener(10000, “priceValence")
```



   II. Test out other QUDs. What aspects of interpretation does the literal listener capture? What aspects does it not capture?

There are QUDs that capture approximate interpretation and that either include ‘valence’ information or not, but there is one combination missing. There is no QUD function for approximate interpretation AND valence.

   III. Create a new QUD function and try it out with “the kettle costs 10001 dollars”.

```
var qudFns = {
  price : function(state) {return { price: state.price } },
  valence : function(state) {return { valence: state.valence } },
  priceValence : function(state) {
    return { price: state.price, valence: state.valence }
  },
  approxPrice : function(state) {return { price: approx(state.price) } },
  // new QUD function
  approxPriceValence: function(state) {
    return { price: approx(state.price), valence: state.valence  }
  }
}
```

We create a new QUD 'approxPriceValence' which considers an approximate price and also returns the valence.

3. **Exercises on pragmatic listener / full model:**
   I. In the second code box, we looked at the joint prior distribution over price and valence. Compare that joint distribution with the listener interpretation of "10000". What is similar? What is different?

      The most striking difference is that the literal listener model does not INFER the QUD but requires it as an argument. The pragmatic listener performs a joint inference on the state (price) and on the likely QUD. What is similar is that both consider the price interpretation "10000" to be the most likely. We can see that most clearly if we look at the *marginal* distribution over prices under the pragmatic listener model, e.g., by calling (see also part IV below):

      ```
      viz.table(marginalize(listenerPosterior, "price"))
      ```

   II. Try the pragmaticListener with the other possible utterances.

   III. Check the predictions for a speaker who paid 501 is aroused (valence is `true`) and wishes to only communicate valence. What's the three most likely messages such a speaker would send? (Hint: use `viz.table` to see all options ordered in terms of their probability; a histogram is not informative in this case.)

      ```
      viz.table(speaker({price: 501, valence: true},
      "valence"))
      ```

      The three most probable utterances this speaker would choose are round numbers, the higher the more probable. This is because these communicate most clearly the desired valence aspect.

IV. Look at the marginal distributions for “price” and “valence” of the pragmatic listener after hearing “10,000”. Do you find these intuitive? If not, how could the model possibly be amended to make it more intuitive?

The interpretation of valence is intuitive: it is more likely that the speaker is aroused about the rather high price. But the most likely state interpretations (under the marginal distribution over price) are less intuitive. The most likely interpretation is a literal one, which intuitively should perhaps receive much less credence.
A possible tweak is to change the prior on QUDs.