1. Supervised Learning is known as learning with a teacher or learning from examples.  The idea behind supervised learning is to take a set of training data that contain inputs and desired outputs and have an algorithm learn to produce the desired output when given an input.  Once the algorithm has learned how to correctly compute outputs, then it can be used to compute outputs for previously unseen inputs.
   1. How to supervised learning algorithms solve regression and classification problems? (I am not wanting a description of the internal workings of the algorithms.)

Bryan’s Response: Classification is to categorize data. Regression is to quantify data.

* 1. What packages in R perform supervised learning?

GBM (Generalized Boosting Models): includes regression methods for least squares, absolute loss, t-distribution loss, quantile regression, etc.

randomForest: classification and regression based on a forest of trees using random input

rPart (Recursive Partitioning): for classification, regression, and survival trees

caret: used for classification & regression training

* 1. What measures of quality of the learning algorithm might you expect to see?

A few I read about include: Mean Average of Precision (exactly what it sounds like), Discounted Cumulative Gain (determines usefulness based on position in a set), Kendall’s tau (association between two measured quantities), Spearman’s RHO (statistical dependencies between two variables)

1. Unsupervised Learning is learning from data.  The idea behind unsupervised learning is to take data and learn as much as you can from it.  The usual thing that one learns is whether there are clusters in the data.  For example, if the data contain weights of elephants and weights of cats (without knowing about the elephants and cats) one might be able to discern that there were two different clusters of data.
   1. How is this related to the statistical clustering problem? I’m not certain I understand this question clearly, but I can say that clustering means taking the data and you have to identify the parameters of a cluster, as well as the numbers of a cluster. This can be tricky if you don’t know that “cats” and “elephants” exist. What if you have cats and raccoons – or other things that are similar? You need to measure the distance between items within a cluster, as well as difference between separate clusters.
   2. What packages in R perform unsupervised learning? Kmeans (computes partitions with respect to distance) and hclust (hierarchical clustering)
   3. What measures of quality for the learning algorithm might you expect to see?

Average similarity of objects in the same cluster:  
http://stp.lingfil.uu.se/~nivre/master/MLLecture6.pdf

1. Reinforcement Learning is also called learning with a critic.  In these problems one executes s sequence of actions and at the end of the problem the critic tells you how you performed.  It does not tell you how to do better.  These problems are also known as sequential decision making problems.
   1. Give some examples of sequential decision making problems.

I suppose a chess game would be a good example. If the goal is for the final outcome to be best, in some cases you sacrifice a pawn to get to the end goal of capturing the king. Move after move is made and a decision is being made to reach the end goal of winning the game.

* 1. Are there packages in R that perform sequential decision making analysis or reinforcement learning?
  2. Perform an Internet search and see if you can find mention of algorithms for reinforcement learning.
  3. Two or more player games are a form of sequential decision making with each player executing a sequence of actions that leads to an outcome, win or lose.  Do you see any problems with analyzing these games or optimizing performance using reinforcement learning? Well, I suppose this makes my answer about the Chess game correct! I promise I hadn’t read this far yet and that was the sole answer I have made up without using Google so far. Anyhow, a problem I would see is you don’t know what the other player is going to do; you don’t know if their move will be logical or not, so that may impact what your next move may be.
  4. Can you see how buy/sell decisions for a stock or other security might be addressed with reinforcement learning?