Solutions to Assignment 1

1. There are many possible answers to this. Answers with Thinking Humanly, Thinking Rationally, Acting Humanly, and Acting Rationally based on the textbook are acceptable; interesting personal approach will be given extra credit of 2.

2. (There are no standard answers, below are some examples)
   Smoking Detector:
   P: Reliable, Able to detect smoke at a reasonable level, alert people.
   E: Different Room
   A: LEDs, audio alarm
   S: Smoke-Detector, Voltmeter on battery.

   Siri:
   P: Correctly process user’s voice into text based on different languages with possible accent. Make correct action with acceptable reaction speed.
   E: iOS device with audio input system working, internet connection, and supported language voice.
   A: Speaker or/and text output to show answers to user.
   S: Speech listener. Touchscreen interaction.

   Deep Blue:
   P: Win by taking optimal step based on the rule, and as fast as possible.
   E: Chess game rule, Opponent, chess game board (either virtual program or real board operating by human/mechanism)
   A: Program/mechanism to move chess piece (digital/real)
   S: Defined program interface.

   Google Car:
   P: Drive legally, less energy/resource consumptions, fast and stable/safe, correct final/multiple destinations,
   E: Weather condition, roads, traffic, Pedestrian.
   A: Steering, acceleration, brake, horn, signal
   S: Cameras, GPS, speedometer, weather related sensors, etc

3. Breadth-first search: (assuming a solution at level 5 in the rightmost branch)
   1+6+6^2+6^3+6^4+6^5-1=9330 for nodes expanded
   (Number of nodes generated: 6+6^2+6^3+6^4+6^5+6^6-6=55980 nodes.)
   (This is assuming the rightmost node at level 5 is the solution.)
   Maximum needed space:55981 (All nodes are needed in memory, so every generated nodes plus the root node.)

   Depth-first search:
   Number of nodes expanded: 8 nodes.
   Generated nodes : 6*8 = 48 nodes.
   Maximum needed space: Every nodes generated, plus the root node, gives 49 nodes.
Depth-limited search:
Expanded nodes: 1+6+36+216+1296 = 1555 nodes
Number of nodes generated: 6+36+216+1296+7776 = 9330 nodes.
Maximum space needed: 6 nodes at every level (5 levels), plus the root node for 31 nodes.

Iterative deepening:
Expanded nodes: 4*6+3*6^2+2*6^3+1*6^4+5 = 1865 nodes
Number of nodes generated: (6*5)+(6*4)+(6*3)+(6*2)+(6*1) = 11190 nodes.
Maximum space needed: 6 nodes at every level (5 levels) plus the root node for 31 nodes.

b) Depth first seems to be the best for time, though it does not give the shallowest solution. If the shallowest solution is needed, then iterative deepening seems to be the best. If the solution is found only down the rightmost path, iterative deepening also seems to be the best, since depth first search would lead to an infinite search.

4.

5. Well described answers will be accepted with answer less than the true solution cost, which is 26.
6. The online search agent must reevaluate its position after every action. This is most important in any exploration problem. An example of a real-world problem is automated car driving, as the car must constantly reassess where the road is and whether there are any potential hazards.