Robotics

Things you should learn:

1. What Karel Capek's 1921 play" R.U.R." has to do with this topic
2. A couple of good definitions of "robot"
3. Types of tasks, e.g. pick-and-place
4. How robot performance is measured
5. Control—open vs. closed loop
6. Characterizing robot motion in term of degrees of freedom
7. Basic mechanisms for movement—simple joints, compound joints
8. How robot motion is effected—types of actuators
9. Characterizing robot motion in terms of working volume
10. Coordinate systems used for describing position
11. Transformation between coordinate systems—world frame, effector frame
12. How "play" in linkages affects accuracy
13. The very complicated problem of acceleration and inertia in robots

Things you should be able to do:

1. Deduce the range of motion of a robotic arm based on its linkages and constraints
2. Produce an "accuracy map" over that range of motion based on "play" in those linkages (you'll have to think about this one)
3. Show how a particular linkage allows an end effector can move from point A to point B in a straight line (or maybe not).
4. Design a robot (linkage) to carry out a pick-and-place operation

Things you should lie awake thinking about:

1. Why, after 90 years, we still don't have universally effective robots. What are the challenges?
2. How to deal with feedback delays (e.g., in robotic surgery)
3. How you might develop an "acceleration map" over a robot's range of motion, given the acceleration of each actuator in the linkage
4. How to deal with inertia and accelerations in complex linkages