CS533 — Written Homework 1 — Due Friday, October 20

1. Construct the best schedule you can for the following scheduling problem. Assume there are 8 units of each resource available.

		Resource Type		
Task	Duration	R1	R2	Prerequisites
0	4	2	6	
1	2	3	3	
2	7	4	2	0
3	1	5	0	0 1
4	5	2	4	2
5	3	3	1	1 2
6	5	3	6	3
7	4	5	5	4 6

2. Consider the game of tic-tac-toe (also known as naughts and crosses). The rules of the game provide a natural problem space. [Note: Exact answers to this problem would take a long time to calculate. You should spend no more than 30 minutes working this problem.]

(a) Give a precise definition of the problem space including the set of all states, the starting state, the operators, and the feasible (or terminal states).

(b) Show an example path through the problem space starting with the initial state and ending with a final state. Show which operator is applied and the resulting state for each step along the path.

(c) What is the branching factor of this space? Express the branching factor as a function of the number of moves already made. (We will consider each move by a player as a single move.) You only need to give an approximate answer.

(d) What is the minimum and maximum solution depth? Show move sequences that produce these.

(e) Estimate the total number of states in the state space. What fraction of these are terminal states? Is this state space redundant? If so, then on the average how many distinct sequences of operators generate a given state? You only need to give approximate answers to these questions.

(f) Estimate the proportion of terminal states in which the first player wins the game. Again, an approximate answer is sufficient.

3. House Floorplanning.

Suppose we wish to design a 1-story rectangular house with dimensions 20 by 40 feet. The house must contain exactly 5 rooms: living room, dining room, kitchen, bath room, and closet. There must be doors connecting the following rooms:

From Room	To Rooms
Living Room	Dining room, bath room, and closet
Dining Room	Kitchen, Living room

In addition, there must be a door connecting the living room to the front of the house (one of the 40-foot long sides). Each door is 2 feet wide.

The living room, dining room, and kitchen must have windows to the outside.

Each room must have the following minimum dimensions:

Room	Dimensions
Living room	10x20
Dining room	10x15
Kitchen	10x20
Bath room	4x8
Closet	3x3

All interior walls must be parallel to the exterior walls of the house and positioned on a 1-foot-square grid (i.e., the length of each wall must be a multiple of 1 foot). All rooms must be rectangular. All space within the house must be part of one of the five rooms.

Design a problem space for this problem (and for problems with the same kinds of constraints). The goal should be to find any feasible solution. Show a sequence of states and operator applications that leads from the starting state to a goal state in your problem space.

What search algorithm do you recommend for your problem space? Why?