Solution for MidTerm Exam

Note: I gave a lot of credit for answers that were thoughtful, independent of whether they agreed with what I had intended to be the right answer!!

1) Short Questions

1a) *False,* RTA* fixed depth-bound search, inter-mixing of acting and planning; not really anytime in the sense that the longer you run the better the answer you get;

1b) *True,* a little tricky because due to depth-first type of search of anytime A* that you get by setting w>.5, you can potentially reach the optimal solution quickly and use this to prune nodes from the open list. However, you will never prune a node that would have been taken by the A* algorithm (w=.5) since heuristic value of an admissible f of necessity is always lower than the exact f. The only nodes that will be expanded in an A* search are those nodes whose heuristic f is less than or equal to optimal value of f since at every point the optimal path will be on the open list and none of these nodes will be pruned by the value of the optimal f.

1c) *False,* Take the example of A*; no gain on average is gained by introducing randomness into the h computation since use of an admissible h in A* guarantees that there is no other way to use this h and expand fewer nodes.

1d) *False,* it is not the relative time between the amount of meta-level search and base-level search that affects effectiveness. Rather how much of the search in the base-level is eliminated as result of the information provided by the meta-level search.

1e) *False,* texture measures and mini-conflict are similar in that they take a more global view of how the assignment of a value to a variable affect the assignment of other values to other variables.

1f) *True,* when Dempster's rule for evidence combination is applied, all the "probability mass: that would be assigned to contradictory subsets of Θ is instead redistributed proportionately.

1g) *False,* it depends on what operator is used to combine the evidence - "max" or "min", and how the sources of evidence are dependent.

1h) *False*, belief network is one way to do casual-based diagnostic reasoning but not the only way

2) Hierarchical Search
The basic idea is:

1. Construct the higher level abstract graph by forming abstraction nodes: each abstraction node contains a group of basic nodes which are very close to each other;
2. Search in this abstract graph to find the path from each abstraction node to the abstraction "goal" node (the abstraction node that contains the "goal" node);
3. Search inside every abstraction node to find paths among each other nodes;

3)

1. Define conflicts as number of neighbor regions that has the same color;
2. Pick the region that has most conflicts (pick one randomly in case of a tie);
3. Try all possible assignment and assign a color that reduce the conflicts mostly to it;
4. Repeat step 2 to 3 until no conflicts there;

4) a) average branching factor and average depth of search space;
b) Effective branching factor of the search graph given a specific heuristic, Hi;
How long does it take to apply heuristic Hi;
Allows you to calculate the cost of applying a heuristic versus not apply it
c) Assuming you are not varying the w
1) using a better heuristic allows you to better focus the search and hopefully you will need to get to solution with fewer nodes being generated

2) using a cheaper heuristic gives you more of likelihood of finding a solution
3) using a better heuristic allows you to drive more quickly to solution since you are probably very close to solution since there are number of h's which are very small this is the answer I thought of first);

In thinking more about the answer to this question I think this may be a complex calculation involving how much you have already searched, what is average depth of the solution, how many more nodes can you search if you use a specific heuristic and how accurate that heuristic is.

5) a) Pick the test that maximize |p(D|E) – p(not D|E)|;
b) E3;
c) E2;

6) a) There are two potential reasons for thinking that this is a good idea. The first is that if hypothesis the ratings are not very accurate in terms of their predictive capabilities about the likelihood of the hypotheses being a part of the optimal solution and if there is a big difference in cost between working on a moderatedly-rated hypothesis (in this case cheap) against a higher-rated hypotheses (in this case significanlty more expensive), then being able to work on more hypotheses in the same amount of time may be advantageous given the uncertainty of the rating. Another reason is that sometimes the correct hypotheses can be constructed by joining together multiple hypotheses, one coming from early part of the speech signal and the other from the later part of the signal. In this case, driving the search from the hypotheses that are leastly costly to expand would be the best approach.

6b) Because even though there was uncertainty in the ratings of hypotheses even with highly-rated hypotheses, the likelihood of highly rated hypotheses being part of the eventual solution was significantly higher and additionally working on bad hypotheses make take a number of steps to realize that this hypothesis should not be pursued further. Thus, working on moderately-rated hypothesis when there were higher-rated hypotheses available to work on rarely paid off.

6c) *Yes*, given that all things were equal except for cost, then taking the lower cost option will never hurt and can only help.

7) P(A|D) = 2/3;