1. Grid City

b)

i. UCS will never terminate because the number of states is infinite.
Ans: False. Since there is a positive constant cost associated with every state, and there is a finite reachable goal, UCS will terminate.

ii. UCS will return the minimum cost path and explore only locations between (0, 0) and (m, n); that is, (x, y) such that $0 \leq x \leq m$ and $0 \leq y \leq n$.
Ans: False. It will explore locations and states possible based on actions.

iii. UCS will return the minimum cost path and explore only locations whose past costs are less than the minimum cost from (0,0) to (m,n).
Ans: True.

c)

i. If you add a connection between two locations, the minimum distance cannot go up.

Ans: True. A new connection could open up paths that were not previously available. However, this new connection would show up in the minimum path only if the path's total cost is smaller than the previous minimum path. Thus, the minimum distance could decrease but never go up.

ii. If you make the cost of an action from some state small enough (possibly negative), that action will show up in the minimum cost path.
Ans: False. Even though the cost of an action is very small, it might lead to a state that ends up increasing the overall cost. Thus, it cannot be guaranteed that this action would show up in the minimum path.

iii. If you increase the cost of each action by 1, the minimum cost path does not change (even though its cost does).
Ans: True. Since the cost of every action increases by 1, the minimum path would not change because the costs of all paths would increase by the same ratio.