Q1

a) *Brute force techniques – Generate and test – will keep generating solution till an optimal solution is found – O(n!)*
b) *If someone just used a generate test technique, then many techniques can be enlisted*
   -e.g. UCS
   -Greedy algorithms etc – Best first search etc
   -Nearest neighbor methods

c) *A heuristic technique search as BFS (best first search or A* has to be used, A* with h(n) =0 is UCS so students can use UCS), student should be able to show a solution using one of the techniques*
   Solution should be: BACDB OR BDCAB = 555

Q2

Random –restart hill climbing technique – conduct a series of of hill climbing searches from initial state until a goal is found. Basically "try try again"

First-choice hill climbing – randomly selecting a move with some probability (similar to stochastic hill climbing) but with the exception that we just want to improve the current state.

Q3

DFS will outperform BFS on thickly connected graphs with high branching factor, because BFS experiences an exponential blowup in nodes expanded as the branching factor increases

Q4.

Lamarckian – Inheritance of acquired characteristics
Darwinian - Survival for the fittest

GA is modelled on Darwinian

Q5.

a) Define a state representation. (2 points)
   There are many possibilities. One example is:
   Represent the missionaries by M and the cannibals by C. Let the boat be B. Each state can be represented by the items on each side, e.g. Side1{M,M,C,C}, Side2{M,C,B}.

b) Give the initial and goal states in this representation. (1 point)
   Initial state: Side1{M,M,M,C,C,C,B}, Side2{}
   Goal state: Side1{}, Side2{M,M,M,C,C,C,B}

c) Define the successor function in this representation. (2 points)

A set of missionaries and/or cannibals (call them Move) can be moved from Sidea to Sideb if:

- *The boat is on Side1.*
- *The set Move consists of 1 or 2 people that are on Side1.*
- *The number of missionaries in the set formed by subtracting Move from Sidea is 0 or it is greater than or equal to the number of cannibals.*
- *The number of missionaries in the set formed by adding Move to Sideb is 0 or it is greater than or equal to the number of cannibals.*

d) What is the cost function in your successor fuction? (1 point)
Each move has unit cost.

e) What is the total number of reachable states? (2 points)
16:

Side1{M,M,M,C,C,C,B}, Side2{}
Side1{}, Side2{M,M,M,C,C,C,B}
Side1{M,M,M,C,C,B}, Side2{C}
Side1{M,M,M,C,C}, Side2{C,B}
Side1{M,M,M,C,B}, Side2{C,C}
Side1{M,M,M,C}, Side2{C,C,B}
Side1{M,M,C,C,B}, Side2{M,C}
Side1{M,M,C,C}, Side2{M,C,B}
Side1{M,C,B}, Side2{M,M,C,C}
Side1{ M,C} , Side2{ M,M,C,C,B}
Side1{ C,C,C,B} , Side2{ M,M,M}
Side1{ C} , Side2{ M,M,M,C,C,B}
Side1{ C,C,B} , Side2{ M,M,M,C}
Side1{ C,C,B} , Side2{ M,M,M,C}
Side1{ M,M,M} , Side2{ C,C,C,B}
Side1{ C,B} , Side2{ M,M,M,C,C}

The last one is only reachable through the goal state, but it is still technically reachable (e.g. if you are just exploring the state space instead of searching for a goal).
These two are not reachable because the preceding state must have had more cannibals than missionaries on one side of the river:
Side1{ C,C,C} , Side2{ M,M,M,B}
Side1{ M,M,M,B} , Side2{ C,C,C}