Question 1

Consider the following constraint satisfaction problem (CSP):

Variables: X_1, X_2, X_3

Domains: $D_1 = \{1, 2, 3, 4\}$, $D_2 = \{\alpha, \beta, \gamma\}$, $D_3 = \{a, b\}$

Constraints:

$$C(X_1, X_2) = \{\langle 1, \alpha\rangle, \langle 2, \gamma\rangle, \langle 3, \alpha\rangle, \langle 4, \gamma\rangle\}$$
$$C(X_1, X_3) = \{\langle 1, a\rangle, \langle 3, a\rangle, \langle 4, b\rangle\}$$
$$C(X_2, X_3) = \{\langle \alpha, b\rangle, \langle \beta, a\rangle, \langle \gamma, b\rangle\}$$

Apply the arc consistency algorithm AC3 to the problem and report the resulting domains.

Question 2

Consider the problem of finding the shortest route through several cities, such that each city is visited only once and in the end return to the starting city (the Travelling Salesman problem). Suppose that in order to solve this problem we use a genetic algorithm, in which genes represent links between pairs of cities. For example, a link between London and Paris is represented by a single gene 'LP'. Let also assume that the direction in which we travel is not important, so that $LP = PL$.

a) How many genes will be used in a chromosome of each individual if the number of cities is 10?

b) How many genes will be in the alphabet of the algorithm?

Question 3

Which of the following situations is a game theory problem? (multiple choice is possible)

1. A perfectly competitive firm determines how much to produce.
2. A monopolist chooses its pricing strategy.

3. An oligopolist decides whether or not to introduce a new product.
4. None

Question 4

What is the time complexity of the following code:

```
def linear2(n, m):
    result = 0
    for i in xrange(n):
        result += i
    for j in xrange(m):
        result += j
    return result
```

Question 5

Consider the following graph where each state has the objective value or measure of quality of states given in Table 1. We can perform an action which would take us from one state to another. Action identifiers are denoted on the edges between nodes. The goal is to perform a sequence of actions that would maximize the objective function. Assume A is the initial state.

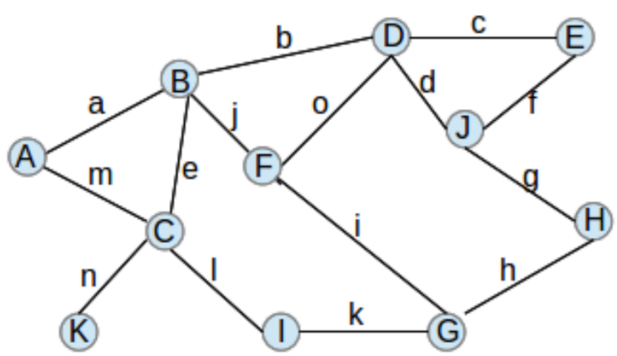

Table 1: Objective values of the states

State	Value
A	1
B	5
C	4
D	7
E	9
F	5
G	4
H	6
I	3
J	6
K	10

If you were to perform hill-climbing, what would be the final state you would reach?