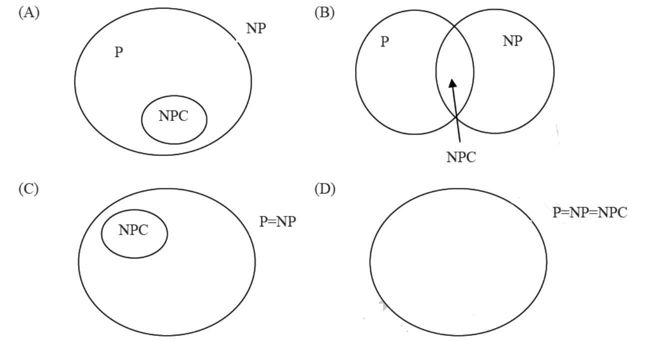
Quiz 1: Evolutionary Computations **Total Marks: 10**

2017-09-13

Name: --- **Registration #: -------------------------------------**

Question 1: (1 point)

Suppose a polynomial time algorithm is discovered that correctly computes the largest clique in a given graph. In this scenario, which one of the following represents the correct Venn diagram of the complexity classes P, NP and NP Complete (NPC)?

	Reason: **Answer: (D)** **Explanation:** Clique is an NP complete problem. If one NP complete problem can be solved in polynomial time, then all of them can be. So NPC set becomes equals to P.

Question 2: (1 point)

Suppose you have k objective functions ($f_1(x)$, $f_2(x)$, $f_3(x)$, …, $f_k(x)$) and you have to **maximize** all. Provide the mathematical definitions of the following:

(i) Domination

x **dominates** *y* if and only if

(ii) Pareto Dominance

Question 3: [1 point] Which of the following problems can be viewed as Search Problems?

P≠NP

(A) Optimization **(B)** Simulation **(C)** Modelling **(D)** None **(E)** All

Question 4: (1 point)

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Calculate the probability that a binary chromosome of length N will not be changed by applying the usual bit-flip mutation with probability $p_m = 1/N$ (probability of flipping a bit is 1/N). Write the general formula for the calculation?

Ans:

Question 5: [3+ 1 points]

Let P = { (1, 3), (3, 1), (2, 2), (0, 4), (1, 2), (1, 4) } denote the objective function vectors of a population of individuals in an evolutionary algorithm for Pareto optimization.

(i) Suppose you want to minimize both objectives. Draw all the points in a 2-D diagram and determine the dominance rank, and dominance count for each solution.

Solution	Dominance rank	Dominance count
(1,3)		
(3, 1)		
(2, 2)		
(0, 4)		
(1, 2)		
(1,4)		

(ii) Minimization problem: If we use aggregation based fitness scheme (weighted sum approach) to assign a scalar fitness value, where f_1 and f_2 are two objectives and w_1 and w_2 are their corresponding weights. Assuming $w_1 = 0.3$ and $w_2 =0.7$, which solution will be the best?