HOMEWORK 2 –SOLUTIONS

Ans1. (a) FALSE

(b)TRUE

(c)TRUE

(d)FALSE

(e)TRUE

Ans2. READ.

Ans3. The speed goes as follows: log functions, polynomials and then exponents[being the fastest] . So we know that f4 (n) and f5 (n) are exponential functions, thus their speeds will be maximum which places them at the end of the order. Comparing f4(n) and f5(n) , we see that 10n < 100n i.e. f4 (n)= O (f5 (n)).

Coming and comparing the rest of elements, f2 and f3, we compare the power of n, and as n0.5<n, thus f2(n)=O(f3(n)). And as f1(n) has n2.5 >n of f3(n), thus f3(n)=O(f1(n)).

Last element being f6(n) , as it is log function but n2logn which means it grows faster than n2 but not faster than n2.5. Thus it is placed between f3 (n) and f1(n).

Ans4. Order is:

G1 is before G5, as (log n)0.5 < log n.

G5 is before G3, as log n is in power in G5 and in G3 it is in polynomial form. And as mentioned in ans 2. We know speed of polynomial is faster than speed of log functions.

G3 is before G4, comparing the powers of n, n< n1.5.

G4 is before G2, as polynomials grow slower as compared to exponential functions.

G2 is before G7, as 2n < 2n2.

G7 is before G6, as in powers, exponential function of G6 grows faster as compared to G7.

Ans5. (i)False. Eg. G(n) =1 , and F(n)= 2. Then taking log (g(n)) =0 < log(f(n)). Thus f(n) > G(n), which makes the statement a false.

(ii) False. Eg. F(n)= 2n, G(n)= n, Then 2f(n) = 4n  for F(n), whereas it is 2n for G(n).

(iii) True. As f(n)<C.G(n) for n>no.  As we square them, the statement still holds true. F(n)2 <C2 G(n)2 for n>no.

Ans6. (i) The for loops are in sequence order, i.e. one for loop inside the other. Thus it takes O(n) 2 to execute. Whereas The summing up of the array entries takes O(n) time. So the total algorithm takes n2 X O(n)= O(n)3.

(iii) for i=1 to n

for j=i +1 to n

B[i][j]=B[i][j-1]+A[j];

Ans7. We consider that G is a connected graph. Let’s run BFS on it and the tree be named as T. Now when we traverse G, and find that G=T, then G is a tree and has no cycle. But if there is an edge (a,b) in G, such that there also exists a node c, and there is a-c and b-c. This creates a cycle. Thus G now represents a cycle.

Ans8. Suppose G has an edge [a,b] that does not belong to T. Since T is DFS, one of the two ends must be an ancestor of the other- say a is ancestor of b. Since T is BFS the distance of two nodes from u in T can differ by at most 1.

But if a is ancestor of b and distance from u to b in T is at most 1 greater than the distance from u to a, then a is fact be the direct parent of b in T. From this it follows that [a,b] is an edge in T, contradicting pour initial assumption.