

This assignment is due on WEDNESDAY MAY 2nd at 5pm.

Put your assignment in one of the boxes labelled CSE 2DMO, on Level 3 of PS2.

**Statement of Originality.** Your assignment must begin with the following statement which must be signed and dated by you:

**DECLARATION:** *This assignment has not been copied at all or in part from other students' work.*

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Date: \_\_\_\_\_

1. (a) Prove that:  $2.2n^2 + 1.1n \log_2(n) - 20n + 15 \in O(n^2)$   
with the choice  $c = 2.5$

(b) To which generic Big O class does  $\sum_{k=1}^n \frac{1}{k}$  belong? No justification is required.

(c) To which generic Big O class does  $\sum_{k=1}^{n^2} \frac{1}{k}$  belong? No justification is required.

(d) To which generic Big O class does  $\log_2(\sqrt{n})$  belong? Justify your answer.

(e) To which generic Big O class does  $\log_2(n!)$  belong? No justification is required.

2. (a) Find the solution to:  $I_n - I_{n-1} = n + 1 \quad I_1 = \frac{1}{2} \quad (n \geq 2)$

For the particular solution  $I_n^P$  you will need to try:  $I_n^P = B \times n^2 + C \times n$

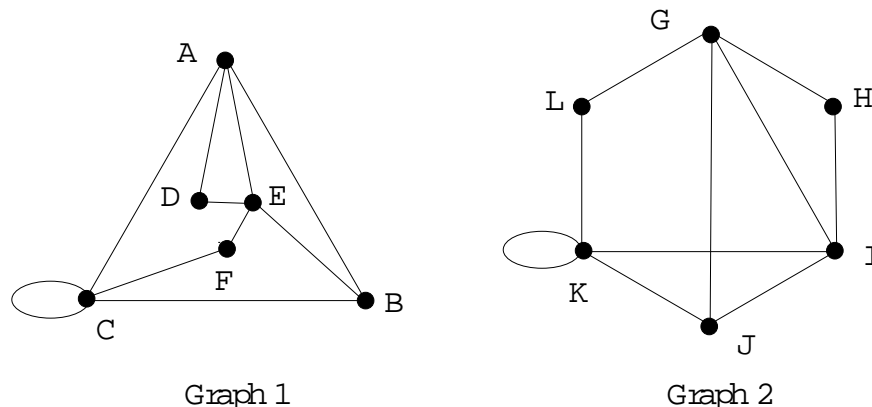
**No check is required.**

(b) Calculate the value of your answer at  $n = 50$ . Show details of your calculation.  
(It should be 1323.5)

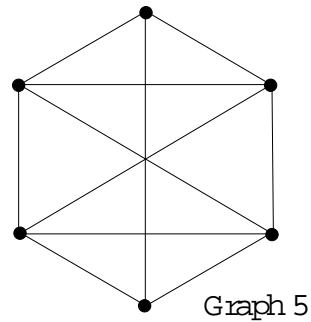
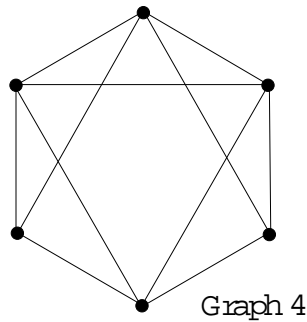
3. (a) Write down the vertex-edge list description for Graph 2.

(b) Write down the adjacency matrix for Graph 2 using the vertices in alphabetical order.

(c) Write down an isomorphism from Graph 1 to Graph 2.



6. (a) Give two reasons why Graph 4 and Graph 5 are **not** isomorphic.



7. (a) Use INSERTION Sort to write down the lists for Pass 3, Pass 4 and Pass 5. Use a line to separate the sorted elements from the unsorted elements of the list.

List to be sorted	After Pass 1	After Pass 2	After Pass 3	After Pass 4	After Pass 5
Hash	Hash	Bubble			
Insert	<u>Insert</u>	Hash			
Bubble	Bubble	<u>Insert</u>			
Quick	Quick	Quick			
Select	Select	Select			
Merge	Merge	Merge			

(b) Referring to (a) above, complete the following table.

	Pass 1	Pass 2	Pass 3	Pass 4	Pass 5
Number of Comparisons					
Number of Exchanges					

(c) Complete the “comparison by comparison” tables below.

**For Pass 3**

(There may be as many as 3 comparisons and 3 exchanges)

COMPARE WITH			
Exchange			

**For Pass 4**

(There may be as many as 4 comparisons and 4 exchanges)

COMPARE WITH				
Exchange				

**For Pass 5** (There may be as many as 5 comparisons and 5 exchanges)

COMPARE WITH					
Exchange					

(d) For a general  $n$ -element unsorted list, how many passes are required to completely sort the list using Insertion Sort?