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DAA - LAB -4

TASK - 1:

Algorithm:

#CSV file format

serial number, Bassage Course-code-1, course-code-2, course-

(de - 3 , Course - code - 4 , course - code - 6

Assumption: Course code should only be

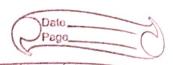
numbers and we writt give error

when it has anything else

// Input: Taken from CSV file with above format

vester = dataset - excsv

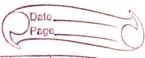
dataset = readcs v (file_path)



Inversion (dataset) // Input: BCSV file dataset of given format 11 output: Dictionary with number of students for every inversion county needed count = [0:0,1:0,2:0,3:0, others: 0] in dataset for each student CC = All course codes of student as array invocunt = Count Inversions (cc) if invocunt == 0 count [o] ++ else if invcount == 1 count [1] ++ eise if invocunt == 2 coun+[2]++ esse if inveount ==3 COUNT ES]++ WOULD count Cothers 1] + + return count Count Inversions (arr) 1/ Input: An An array of positive integers Moutput: Number of Inversions in garay if len(arr) < = 1: return & arr, o mid = len (arr)/2 lestinu lest, lestinu = count Inversions (25th half of array right, rightinv = Count Inversions (2nd houf of array. merge, splitinv = Mergeand CountSplit (left, right) return merge, lestinut rightinut splitinu



Merge and Count Split (left, right) // Input: 2 arrays left & right Housens counts number of split investions Moutputs: Return sorted mersed growy & counts number of cruit invenion result = [] i = j = split = 0 n = len (left) while ixlen(left) and jxlen(right): [i] +deir => [i] +791 7; result. append (left [i]) 815e result. append (might[i]) <u>j++</u> Spli+ + = len(lef+) - i result append (All elements right of left [i]) result append (All element right of right [i]) return result, split



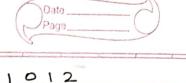
0.00	
CONTRACTOR OF THE PROPERTY OF	Test cases:
	give appropriate
\$r.	For positive testcases give appropriate
10 4 4 25 mm 1	
	for negative testcases:
	a Day of the Course Codes
	Output: INVALID INPUT
	7. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.
	Output: EMPTY FILE
	· If any column is left unfilled:
	OUTPUT: INVALID SIZE OF COLUMNS
	Output: INVALID SIZE CO
	a transfer to the second of the second of
	Positive test cases:
•	Output: There are O students with O Inventor
2	There are 4 students with 1 Inversion
	There are 3 students with 2 Invento
	10 71 10 71
	· · · · · · · · · · · · · · · · · · ·
	There are 83 students with Other Inversi
11	Input: student - course - codes - 2
· -	output: There are 2 students with o Inversions
	There are 3 students with 1 Invention
	There are 10 students with 2 = Inversions
	There are 15 students with 3 Inversions
	There are 70 students with other Inversions
of the second	
	The state of the s

	Task - 2:
	Algorithm:
	Normal Multiplication (x, y)
	1/2 Input: 2 Large Integers x & y
100	11 output: Product of 22 &y
	$n_1 = len(n)$
	$n_2 = len(y)$
+ ,	if x == 0 or y == 0
	return o
	Initialise 'prod' string of size n1+n2 of Os
. Satuli	for each digit i from right to left in x
Anna S	cy = 0
	for each digit is from right to left in y
STATE OF THE STATE	result [i+j+1] = x [i] + y [i] + cy
	Produ = x [i] * y [i]
12,131	2 man total = produt carry + & prod [ititi]
	2 prod Eititi] = total%10
	carry = total/10
	p-od[i+j]+= cy
E STO	Remove leading zerog from result prod
	return production
RIVE A	224121 6 24 10 24 10 25 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	Theat will be a second

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R	

	Karatsuba (x,y)	
	11 Input: 2 large integers 2 & y	
	11 Ourput: product	
	if len(x) == 1 or len(y) == 1	_
	return x * Y . 50 0 mile . Milomore) !
	m = Half the length of longer number	
	Split X into X12 X0	
	Split y into y1 & y0	
	$P_1 = Karatsuba(X_1, Y_1)$	f's
	P2 = Karatsuba(Xo, Yo)	
	Pa = Kanatsulas (x, +Xa, y, +Yo)	
	Result = P1 * 10^(2*m) + (P3 - P1 - P2) * 10 n	n + P2
	return tresulting and i diel and	
7		
	TESTCASES - MONTE COMMENT	
-	Re List delise elles Ethory	
1-	- x = 10, $y = 110/1 + 1/1/10 = 1/11$	
	Dutput: Product by Normal Multiplication i	7 100
· •	Product by Karatsuba is 100	
	in: The field there	
2.	. n= 1111111111 , = = 1111111111111111111	
	Output: Product by Normal Multiplication	, is
	12345678987654321	
	Product by Karatsuba is 1274.	5678987651
	5.	
٤.		
	Output: INVALID INPUT	
٧.	1. n = abcd , y = 2	
9	OUTPUT: INVALID INPUT	
52	<u>5</u> .	



5. $\chi = 12345678987654321012$ y = 21012345678987654321Outents Product by normal Multiplication is

Outputs Product by normal Multiplication is

25941167453040695067235848193782289

Product by Karatsuba is.

259411674530406950672358481937822892852

TIME COMPLEXITY:

· TASK 1:

Brute Force:

· It has 2 nested loops without

any termination

i.; Each loop runs for n iterations

 $f(n) \in O(n^2)$

· ... Time complexity is o(n2)

- Divide & Conquer

· we divide array in 2 halves and the count split inversion in o(n) time

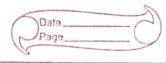
· :, T(n) = 2T(1/2) + 0(n)

By master theorem

 $b^{d} = 2^{l} = 2$ $a = b^{d}$ a=2, b=2, d=1

:, T(n) e o(nlogn)

· ... Time complexity is my o(nlogn)



	3
O Task 2:	
Brute Force:	
	e y to soo have some
length of n	t 9 to soo have some
0 to n-1	ested loops, looping from
$0 + 0 - 1$ $T(n) = \sum_{i=0}^{n-1} \sum_{j=0}^{n-1} 1$	
$T(n) = n^2$	
· , T(n) e o (n2)	
· : Time complexity	11 0 (n2)
Divide & Conquer:	
There are 3	recursive calls for
multiplication & a	ddition takes O(n) time
·, T(n) = 3T(1/2) +0(n)
· By master metho	
a=3, b=2, d	
b ^d = 2 ¹ = 2	
asbd	
'; T(n) € 0 (nlog2	3
T(n) \in o(n ^{1.58}	5)
(Ch) C 0 C11	, -(1.555)
:., Time complexit	1 13 0 (n 3 3 3)
	, f'