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Design	and Analysis of	Algorithms
	and Analysis of Digital Assignme	nt - 1
275		Ry KS X

Winter sem 2023 - 24.

Value and calories of each food are given.

Total calories comsumed must be extmost 800

food	wine	been	pizza	birger	fries	coke	apple	donvit
value	90	90	30	.50 .x = B	90	79	90	Ø(
calories	123	154	258		365	150	95	195

This problem is essentially just the 0/1 knapsack problem.

we have to maximize the total value of

the meal, while ensuring that the calories greaters thanna 800 MING LIND TUN

This is like choosing items such that the total profit is maximum but total weight does not exceed the capacity of the knapsack.

梅·

value: The following mappings can be dome.

values can be mapped to profit (P)

calories can be mapped to weight (W)

The max calories that can be consumed & can be mapped to capacity of knapsack

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The table can )	e rewritten as
-----------------	----------------

Street, or other Designation of the least of					10000	10000				
I+	em	21	22	23	24	215	26	27	28	
	بلدس				10.0	2.5 -		00.0.0	7116	,
P		90	90	30	50	90	79	90	10	
		RUNN J	9V19/	T OF	Ju so	av- 5	12/0 A	W. F	2.7007	l
W;		123	154	258	354	365	150	95	195	I
4.4		ist of	YWM	1 29/0	IN SUCH	5	ore al	Las I	وإسلا	
								The second second second		

Each food item is represented by as as:

B wine - 24

952 beer - 2/2

2 pizza - 23

burger - 24

fries - ns

coke - 26

apple - 267

donut ag listread is meldong isin.

Now this can be solved by any method unich is used to solve of knapsack problem i.e. Branch and Bound Dynamic Programming Backtracking.

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ment exist the appoint of the known

CAT Six of Logger of an Braker

Allegrania of market 19 in ten 2017 and

A TO VIDAL OF JOSCHAR WE THE

(22) Karatsubate Multiplication. 9786 × 1129  $\Rightarrow$  9786 can be written as  $97 \times 10^2 + 86$  7129 can be written as  $71 \times 10^2 + 29$ Total 4 digits in each number, n=4 1/2 = 2: 9786 × 7129 = 智 (10n/2 (97) +86) (10n/2 (71)+20  $(10^{n/2} a + b) (10^{n/2} c + d)$ = 10 n ac + 10 1/2 (bc + ad) + bd CHART TELEPONE (97 ALTE TILLE) Now for comp (a+b)(c+d) = ac+bc+dd+bd.Be + ad = (a+b)(c+d) - ac -bid. (KSTIT) (08+19) = 28×11 + BAX+ 11-2 Values of Fac, bd, (a+b)(c+d) need to be Hence, 4 multiplications got reduced to 3 multiplication Also after each step, the of no. of digits in the nos becomes half The algorithm calls oitself recursively thrice on 1/2 digit numbers. T(n) = 3T(n/2)Putting n -> n/2 T(n/2) = 3 T (n/4) :  $T(n) = 3^2 T(n/4)$   $T(n) = 3^3 T(n/8)$ 

Tin) = 3' T (1/2i) is general form of recurrence relation.

```
Applying master's Theorem.

T(n) = a T(n/b) + f(n)

Here, a = 3, b = 2, f(n) = 0 \Rightarrow k = 0.

a = 3, b \times = 2^{\circ} = 1.

T(n) = 0 (n \log_2 6)

T(n) \approx 0 (n \log_2 6)
```

Applying on given nos:

9786  $\neq 7129$ .

n=4, n/2 = 2.

=  $(97 \times 10^{n/2} + 86)(71 \times 10^{n/2} + 29)$ =  $10^{n}(97) \neq (71) + 10^{n/2}(97 \times 29 + 71 \times 86)$ +  $86 \times 29$ .

Now (97 +86) (71 +29) = 97 ×71 + 97×29 + 71×86

- 97 1×29 + 11 ×86 = (97+86)(71+29)

of book (bro) (den) bd = 1897 x71 5 86 x29.

 $Reg Am = 10^{9} (91 \times 71) + 10^{9/2} ((91+86)(71+29) - 97 \times 71 - 86429)$ 

A: 97 x7)

= (9x10'+7) (7x10'+1) ent of

 $= 10^{2} (9)(7) + 10 (9x1 + 7x7) + 7x1$ 

= 102 (9x7) + 10 (9+1) (7+1) - 9x7 - 7x1)) + 7x1

x=63, y=16x8=128, z=7.

 $A = 10^{2} (63) + 10(128 - 63 - 7) + 7$  = 6300 + 580 + 7 = 6887

TEAN - TO THE STATE OF THE PARTY OF THE PART

```
B: (97+86) x (71+29)
  = 183 x 100
  > n = 3, Ln/2) = 1.
(18 × 10 +3) (1×10+0)
   =10^{2}(18\times1) + 10(18\times0+3\times1) + 3\times0
 = 10^2 (18 \times 10) + 10 ((18+3)(10+0) - 18 \times 10 - 3 \times 0) +3 \times 0
 = 7
 n = 180, y = 21 \times 10, z = 0
 9 y: 21 ×10 > n=2, [1/2]=1.
     10 (2×10+1) (1×10/+0) MATE
        =10(2 ×1) +10 (2x0+1x1) +1x0
        = 102 (2x1) + 10 ((2+1)(1+0) - 2x1 - 1x0) + 1x0
         \alpha = 2, \beta = 3x1 = 3, \delta = 0.
  \frac{1}{2} \cdot \frac{1}{4} = \frac{10^2}{2} \cdot \frac{10}{2} + \frac{10}{3} \cdot \frac{3}{2} - \frac{10}{2} + 0
          = 200 + 10
         = 210.
       put in B
B = 102 x + 10 (4-2+2) + 2
    = 100 (180) + 10 (210 - 180-0) +0
     = 18000 + tage 300
      = 18300
C: 886 x 29
   > 8 n=2, n/2 =1
   (8 \times 10 + 6)(8 \times 10 + 9)
   = 102(8 x 2) + 10 (8 x 9 + 6x2) + 6x9
   = 102 (8x2) +10 ((8+6)(2+9) - 8 x2 - 6x9) + 6x9
   p = 16, q = 154, r = 54
                                          95
 C= 102 x16 + 10 (154 - 16-54) + 54
   = 1600 + 840 + 54
    = 2494
```



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Put values of A, B, C in D,

Any =  $10^{9} A + 10^{9/2} (B - A - C) + C$ =  $10^{9} \times 6887 + 10^{2} (18300 - 6887 - 2494) + 2494$ = 68870000 + 891900 + 2494= 69764394211 01 + (ax 21) 501 =

9786 x 7129 = 69764394

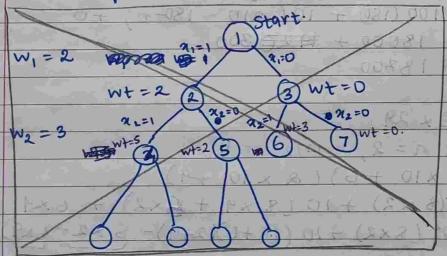
Q3) The Apply backtracking for sum of subset 0x1+ 0x2 M= 10 (14.5) 01+ (14.5) 51

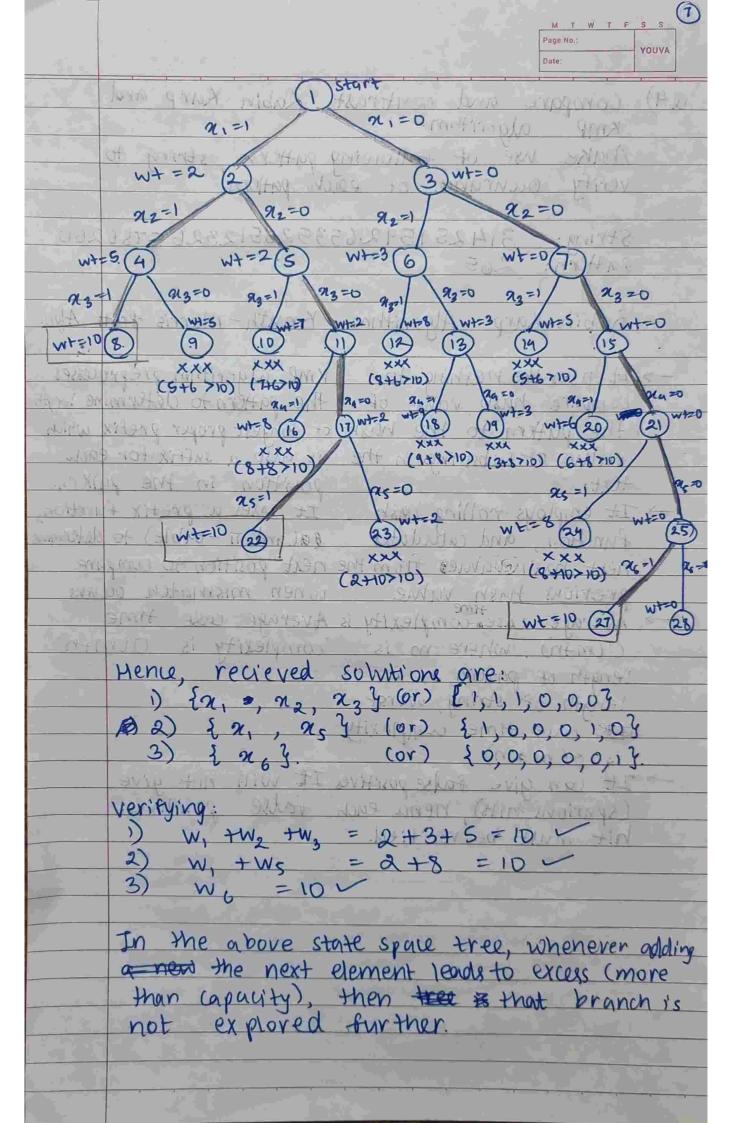
 $W = \{2, 3, 5, 6, 8, 10 \}$ 

-> w is already sorted in ascending order. n=3

M = 10.

State space tree.





8		MTWTFSS
		Page No.:  Date:
04)	compare and contrast	Rabin Karp and
	Kmp algorianm.	10/1/6
	Make use of following verify occurance of ea	pattern, string to
	verity occurance of ea	on pattern.
	String: 31425159265	35265 2326 5786260
	pattern: 265	1 (2) Style (pol) Berling
Ų.		A Vi on O Vi on
Us.	Rabin Karp Algorithm	Knuth - Morris - Kratt Algo.
->	It uses the nashing to	KMP algorithm preprocesses
	compare hash value of	the pattern to determine length
	the pattern to the hash	of longest proper prefix which
	value of substrings in the	is also a suffix for each
(a, b)	Tt analous malling back	position in the pattern.  It was a prefix function,
(45)	It employs rolling hash function, and catulates	eg(and T-table) to determine
× 34 /4=	next hash values from the	next position to compare
DI WA	previous hash value Average case complexity is	when mismatch occurs
<b>→</b>	Average case complexity is	Average case time
. uriti	O(m+n), where m is	complexity is Olmith)
	length of pattern, n is length of string, worst	
	case case time complexity	222 22
	It can give false positives (spurious nits), nenu each	1.6.0.1.6
<i>→</i>	It can give false positives	It will not give
	hit must be verified.	tause positives.
	THE MUST BE VEHILLE.	
- gallala	-septente 127- Ango 34	15 SYNTS STREET
	and service of church dispersion	
	Course Short St 19th (1917)	Darridge don
		Control of the second

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Checking	string	for	patter	n.	1.623.1	13.5
,	5 J. F.	2 + 01	1x ( ) 26		4587	3 04

A) Rabin & Karp. 120

Pattern = "265"

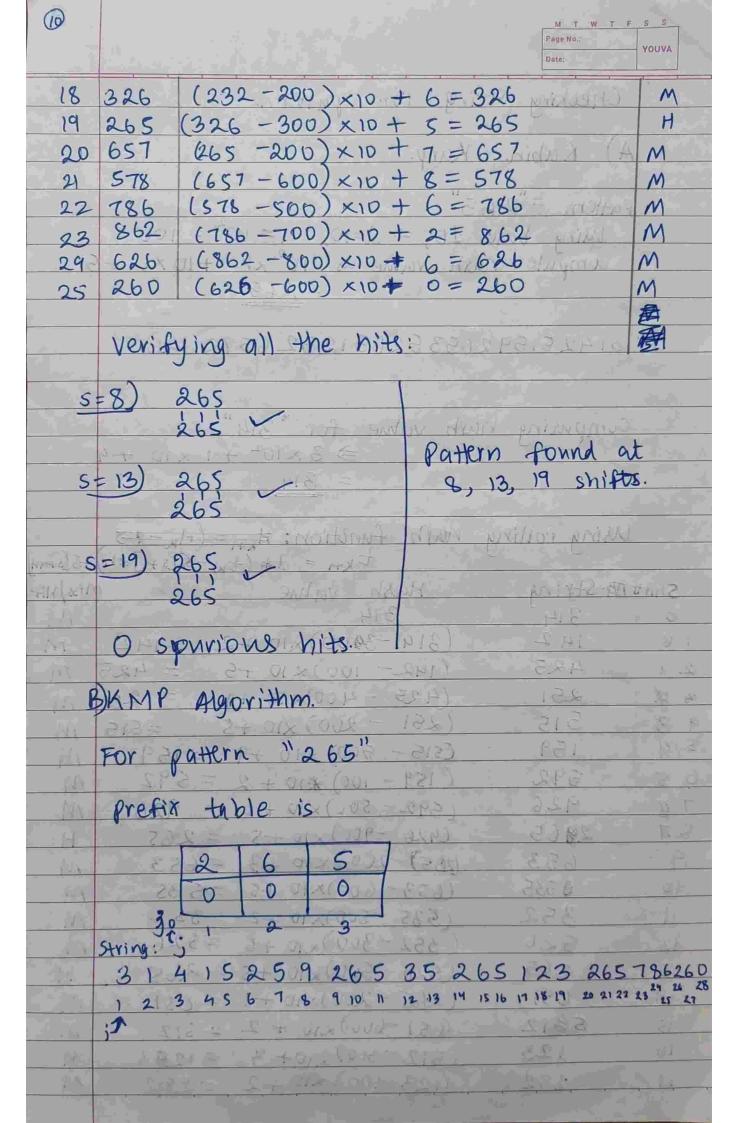
Wing base 10,  $\Rightarrow$  d=10,  $n = 10^2 = 100^2$ Compute hash value as  $10^2 \times 2 + 10 \times 6 + 5$ 

S= 3142515926535265123265786260

Computing hash value for 314"  $\Rightarrow 3 \times 10^2 + 1 \times 10 + 4$  = 314

Wing rolling hown function: # = (Hx - +5)+5(s

		LKH = d* (tx-3(3+1)*h)	+5 [S+m+
Shift	A String	Hash value "	
0	314	314	M
) Ø	142	(314-3400) x10+2=142	M
2 X	425	(142-100) × 10 +5 = 425	
37	251	(425 - 400) × 10 +1 = 251	m
43	515	(251 - 200) x10 +5 = 515	M
5 4	159	(515 - 500) x10 +9 = 159	M
68	592	(159 - 100) *10 + 2 = 592	M
78	926	(592 - 500) × 10 + 6 = 926	M
81	2065	$(926 - 900) \times 10 + 5 = 265$	H
9	653	(265)-200)×10+3 = 653	M
10	<b>0</b> 535	(653-600)×10+5=535	M
И	352	$(535 - 500) \times 10 + 2' = 352$	M
12	526	(352-300)x10+6=526	M
13	265	(526-500)x10+5=265	Н
79	15 10 4 651 0 at 51	(265 -200) ×10+1 = 651	M
15	5012	(651-600) ×10+2=512	M
16	123	(512-500) x10+3 = 1253	M
17	132	(123-100) ×10+2 = 232	M



						onte.	
	j	ĵ	P[j+1]	scij	PLIHI	Toperation	n.
770	di	15.11		4 76	PLjHJ ==scij?	Operation	j==m?
	0	1	2	3	No	1++	× .
ĸ₽Ŀ <u></u> ,,~~Ġ	0	2	2		No	3 144 1-8-21	X
	O	3	2	4	No 8	1144 6 5 11	×
	0	4	2	2	yes !	1 1++, 1++ 6 - 62	$\times$
	)	5	6	5	No	j= T[]]	×
	6	5	2	5+	No	CONTRACTOR OF THE CONTRACTOR	- ×
	0	6	2	1	No		*
	0	7	2	5/10	Non	1++ 1++10 Harry	1 22
	0	8	2	0.94	NO 1	PLOVE MILE	×
	0	9	2	2	yes	i++, j++	×
	1	10	6	6	yes S	F1++, 1++	×
	2	n	5	5	Yes	i++, 1+++	**
	<b>3</b> 3	12		3	ۇ ./پ	1++, j++ 1++, j+++ j = T[j]	V
	0	12	2	13	No	1++	X
	0	13	2	5	No	j++ /_	X
	0	14	2	2	પુથ		3X
	1	15	6	6	yes	i++, j++	×
(3)	2	16	5	5 2	yes :	i++, j++	9X ×
	3	17	-		₩	J= TCjJ	AV
	0	18	2	2	yes a		×
	)	189	6	3 00	No	j= T Cj]	×
	0	199	2	3	No 3	74+ 5	×
	o	20	2	20	yes	5++, 5++>	×
	ELC	21	+61.		yes	111 H ( ++ ( ) ++ ( ) ++ ( )	×
	2	22	5	5	પ્રથ ે	1++, 1++	/×
	3		5	7	7- 6	)=π Cj J	~
31 7 70	0	23	2	70	No	3.0	X
	0	24	2	8	No	1+4	×
3 4	0	25	2	6	No	144	X
	0	25	2	2	Yes	1++, j++	× × ×
	1	27	6	6	Yes	i++, j++	× ×
	2	28	5	50	No	END	κ.
F -	di Arti	(TY	JU	9	Te . 5		
		14 .			h 3.		
			-	10.	E. 15 St.		

considering 1 as middle vertex. O 

A2 = > considering 2 as middle 1) -2 vertex -5 

=							1
	$A^3 =$	0	6	. 8	(7)	-4	石
		00	0	00	(1)	7	
		$\infty$	4	0	5	112 (1	10,00
		2	-1	-5	0	452	
	T.	00	000	1000	3	0	plake
			T II	37		417	

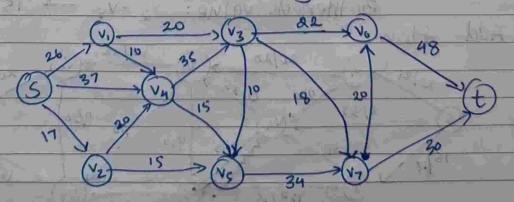
$$A^{4} = \begin{bmatrix} 0 & 6 & 82 & 7 & 4 \\ 3 & 0 & -4 & 1 & -1 \\ 7 & 4 & 0 & 5 & 3 \\ 2 & -1 & -5 & 6 & -2 \\ 5 & 2 & -2 & 3 & 0 \end{bmatrix}$$

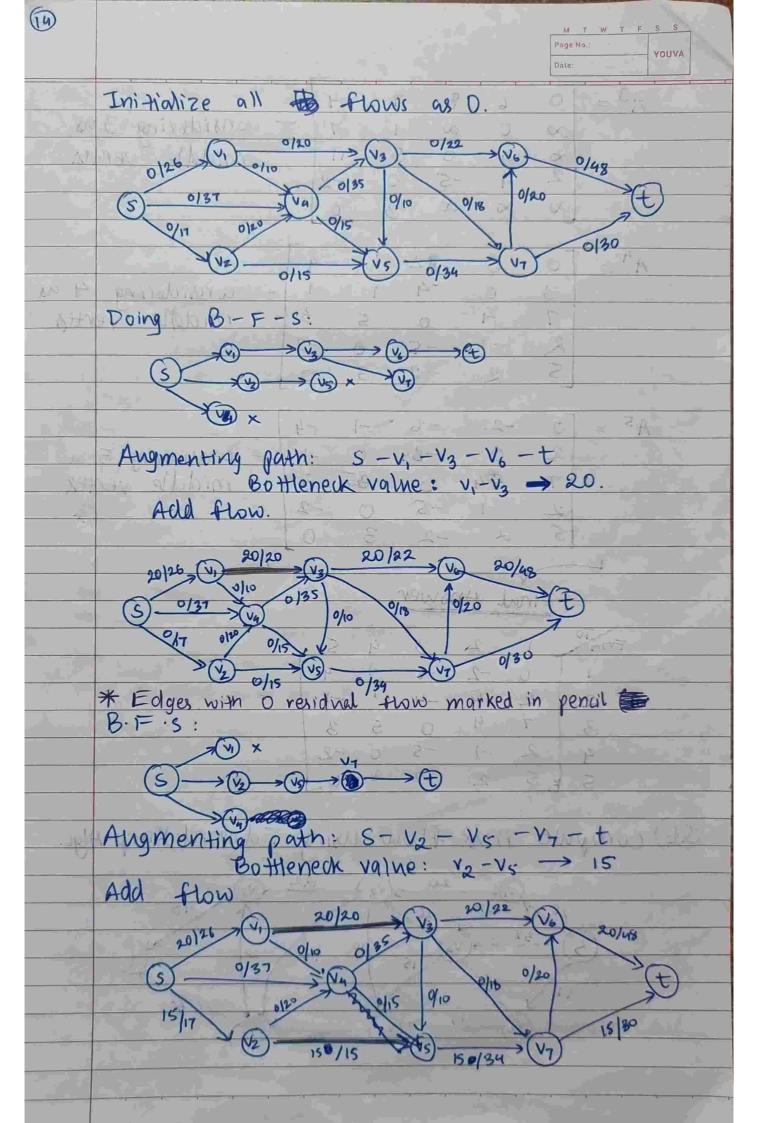
$$A^{5} = \begin{bmatrix} 0 & -2 & -6 & -1 & -4 \\ 2 & 0 & -34 & 1 & -1 \\ 7 & 94 & 0 & 65 & 3 \\ 2 & -1 & -5 & 0 & -2 \\ 5 & 2 & -2 & 3 & 0 \end{bmatrix}$$

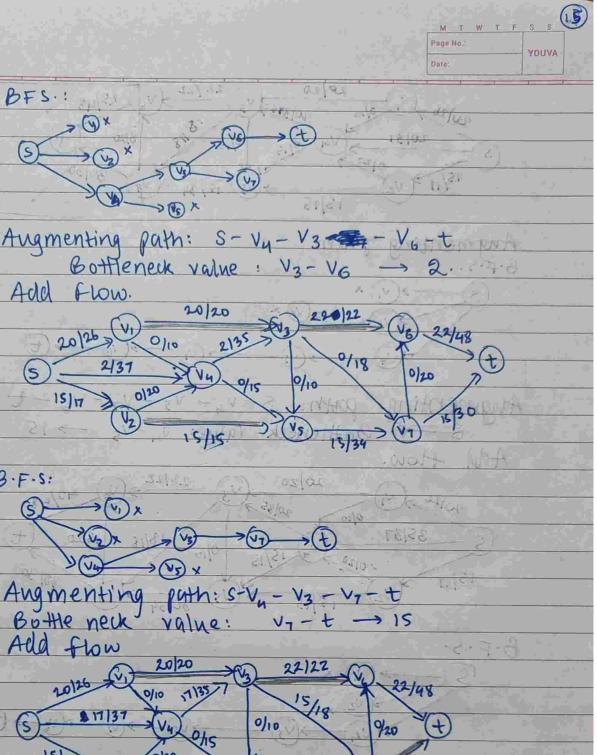
## Final Answer

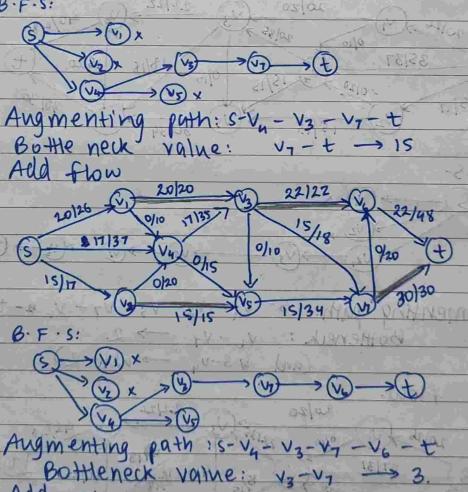
	The same of the sa					
FromTo	1	2	3	4	5	
	0	-2	-6	-1	-4	1
2	2	0	_4	Phy.	-1	
3	7	4	0	5	3	
4	2	-1	-5	0	-2	
5	5	2	-2	3	0.	1987
						85

## Q6) compute max flow using Edmond Karp Algo.









BFS .: Spill State of the state

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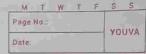
Flow.

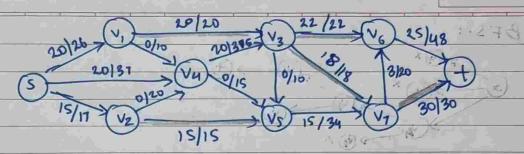
15/17 0/20

Add Flow.

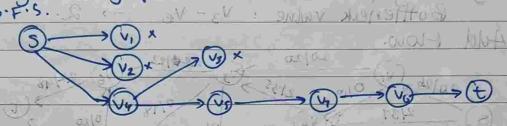
3434



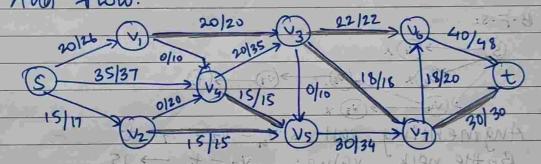




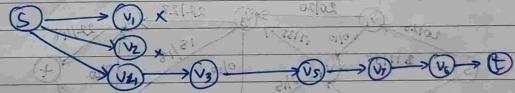
B.F.S. S - W - EV : SNINE WHOSHOS



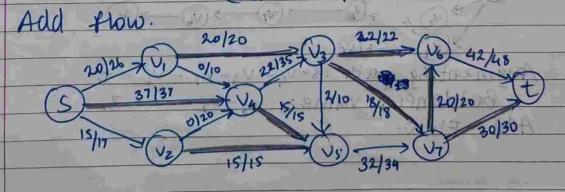
Augmenting path: S-V4-V5-V7-V6-t
8-V Bottleneck Value: V4-V5 -> 15
Add flow.



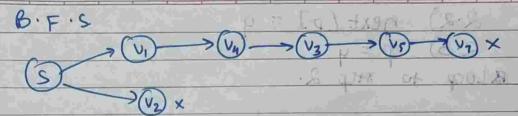
B.F.S.



Angmenting path:  $S-v_{4}-v_{3}-v_{5}-v_{7}-v_{6}=t$ Bottleneck:  $v_{6}-v_{7} \rightarrow 2$ (and  $v_{5}-v_{4} \rightarrow also 2).$ 

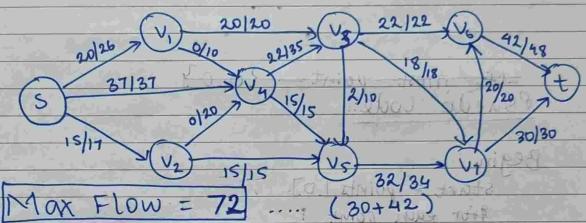






No more augmenting paths. possible.

Final Network:



Q7) Write a program to read the given coordinates and compute the Hull boundary by implementing Jarvis march Algorithm using given set of points and prove that your algorithm should print the boundary coordinates as given below.

{ 20,3}, {4,4}, {3,13, {0,0}, {1,23, {3,13, }3}}

8 20,33, {4,4}, {3,13, {0,0}}

-> Algorithm: ma Manso i donos

Step 1 in Initialize p at left most point step 2: Do while we don't some back to initial

2.1) Next pt is question that (p, q, r)
is is counter clockwised for any pt r.

To do this, initialize q as next pt and
if pt i is more counter clockwise than q,
up date q as i.



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3-4-6

2.2) next [p] = q, 2.3) p = q 3.100p to step 2.

AND MENTING BOTHS TOSSIBLE. FIRELY NEDWOODS

Psuedo code:

Begin

start = points [0] for each point i, the wold wold

obvious novif points [i]. 2x start. 2 , 19 1 Sivind 15

then start = point [i] I swammer

done if points (13.2 = start 2 and points 113.4 < start 9 ing Jahvans (start + points fill ) 90000 ban

o current = start on brook problemad

add start point to result set.

create call Pts gray for storing collinear pts.

BOWNARY COUR MARKS 940: while true, do (Infinite Loop)

next = points [i]

for all points i except on point if points (i] = current then,

continue, to next iteration

wal = cross product of current; next, goints [i] if val > 0,

three Monext = points City (1.

clear coll Pts array

lon to son solse if val = 0,

if next is closer to current than points (i) add next in the coll Pts

			44		next	= p	oints	C: 3			
		-14	(n p	wels	P(1-1)	2 (2-1	Ú	797	ρ	No. 1	
						point					
	73 78 0	4 6-1	34 64 /6	lano .	8	( - 8) (	- 0)	12.28	1 1	£8.03	
				add	all :	tems i	nu	110 /1c	into	result	y the
	Y = 0	€ -€=	3210734	if *	e nex	t = 8	tart	then	15.53	(e os	
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granto atri	(Sel. 9	والداركات	uto" Cla			xt int			रेम मरे	(8.0)	75
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Ta,120	18.27	1-10 V	YN 3/9	1102	3	4					
			(0,0)	= 0							
	(p-	- q )x	(n-0	= ((	P. X	- 9.2	0-14	p.y -	9.4	Longis	
<u>k</u>	'				V. 2	- 9.x	0-6	r.y-	9.4	<del>- 14</del> _	
- Y	392)	5 3		emic :	03-10	18 0	- 12 /	13,15	Toos	lo us	
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				Edition.		1/25/1	
	P	9					(p,q,r)
		54 lbs	191.	1.0 21	yju y	Julys	
	{0,3}	11,13	{2,2}	(0-1)	13-0	= -30	clockwise => q=r
			200 11 1	(4.01)	100	. 11 -	
	20,3}	22,23	24,43	0-2	43-2	=-640	clockwise $\Rightarrow$ $q=r$
			1900	1341-2	4-2	World	
	<i>{0,3}</i>	24,45	20,0}				counter clockwise. > No change
	. 7						in q
	20,33	44,43	21,29	0-4	1-4 =	40	counter cu
	5. 2	<b>(</b> )	( ) ]	3-4	2-4	11 - I	Wash rowhor
	10,53	24,43	1315	8-4	3-4 =	罗 40	counter aw
0.7	5-27	5 7	5007	13-4			
2 }	70,35	14,43	10,23	3-4	3-4 =	370	counter cust
	7 701	9 /	-> -			22	
	NOW	(p, (	9)=	( (0,3)	, 44	,930	is of such that?
	Nov	CK9,	N) 12	S 1,	42	Clocky	vise for all pts r.
-	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	y Yv	P	17,	7]	anu	wntinue.
	2443	5033	81 13	4-0,	-0-1	9 40	clockwise => set q=r
		,,,,,	17/3	4-31	-39		chockwise >> set q=r
	24,43	21,13	\$2.2}	14-1	2-1	=0	⇒ collinear. €
		* ) . 3	10)3	4-1	2-1		(2,2) closer 1 add (2,2) in
						7	coll Pts array
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							coll Pts array = [ (2,2),[1,1)]
							Q = (D, D)
	24,43	{0,0}	21,23	4-0	1-0	04 70	to counter aw.
		₹0,0}	- y - v	4-0	2-0	70.90	
	24,45	80,03	13,13	14-0	3-	0 =-840	dear coll pts grow.
				14-0	1-1	0 1	-> clear coll pts gray.
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1				147	3-1	1	-3 Classe call lete aversu
	想	(3,	1) 1	is +	he	next	pt
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	- Y						

P 99 P r	(q-q) x (q-r)	(8,9,2)
{3,13 {0,33 {1,13	3-0 1-0 = 4<0	clockwise => q=r
13,13 11,13 {2,23		countir cw.
43,8 41,13 44,43	3-1 4-1 = 6 >0	counter cw.
23, 17 20,03 20,03	137 0-1 =-1 <0	doukwise => q=r.
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continue Wi	I in the solution $p = 10,0$ ?	ion set.
N 8		
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{0,0} {0,3} {1,1} {0,0} {0,3} {2,2} {0,0} {0,3} {4,4}	0-0   =3 >0   0-3 -2   =6 >0   0-0 2   =6 >0   0-3 -1   = 12 >0   0-3   = 12 >0	counter au counter au
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Final solution:

{ {0,33, {4,43, {3,13, {0,0}}}

Final Convex Hull  10 20 12 20 20 20 20 20 20 20 20 20 20 20 20 20	(22)	
Final convex Hall  The convex of the convex has been convex to the convertex to the convex to the convertex to the convex to the		Page No.:
THE CONVEX HAND.  THE CONVEX H	<u> </u>	
######################################		CAPINI CAPIX (P-Q Y RIPE)
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######################################	- Y	(3,4 20,3) 1,13 3-01-0-4<0 clocking = 0-
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13.17 (0.01 13.3)   3.12   6.20   6.1	- 1 - N.	De 2: (2,2) (2,2) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) ( ) (
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