unit-5 :

part - II (Back Tracking)

1. subset problem:

Algorithm:

step 1 : start with an empty set.

step 2 : Add to the subset, the next element from the list.

step 3 : If the subset is having sum d then stop with that subset as solution.

step 4 : If the subset is not feasible or if we have reached the end of the set then backtrack through the subset until we find the most suitable value.

step 5 : If the subset is feasible then repeat step 2.

step 6 : If we have visited all the elements without finding a suitable subset and if no backtracking is possible then stop without solution.

Eg :

refer - P, NP, (PDF) :

N-Queens problem :

2 X 2.

| | |
|---|---|
| Q | |
| | Q |

Not possible.

4x4.

| | | | | |
|---|---|---|---|---|
| 2 | | Q | | |
| 4 | | | | Q |
| 1 | Q | | | |
| 3 | | | Q | |

246135.

6 x 6

| | | | | | |
|---|---|---|---|---|---|
| ~~Q~~ | Q | | | | |
| | | | Q | | |
| | | | | | Q |
| Q | | | | | |
| | | Q | | | |
| | | | | Q | |

8 x 8

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 7 | | | | | | | Q | |
| 5 | | | | | Q | | | |
| 2 | | Q | | | | | | |
| 4 | | | | Q | | | | |
| 6 | | | | | | Q | | |
| 8 | | | | | | | | Q |
| 3 | | | Q | | | | | |
| 1 | Q | | | | | | | |

4
6
8
2
7
1
3
5

5
7
2
4
6
8
3
1

Branch & Bound:

1. Knapsack.

$\boxed{W = 10}$

Q.)

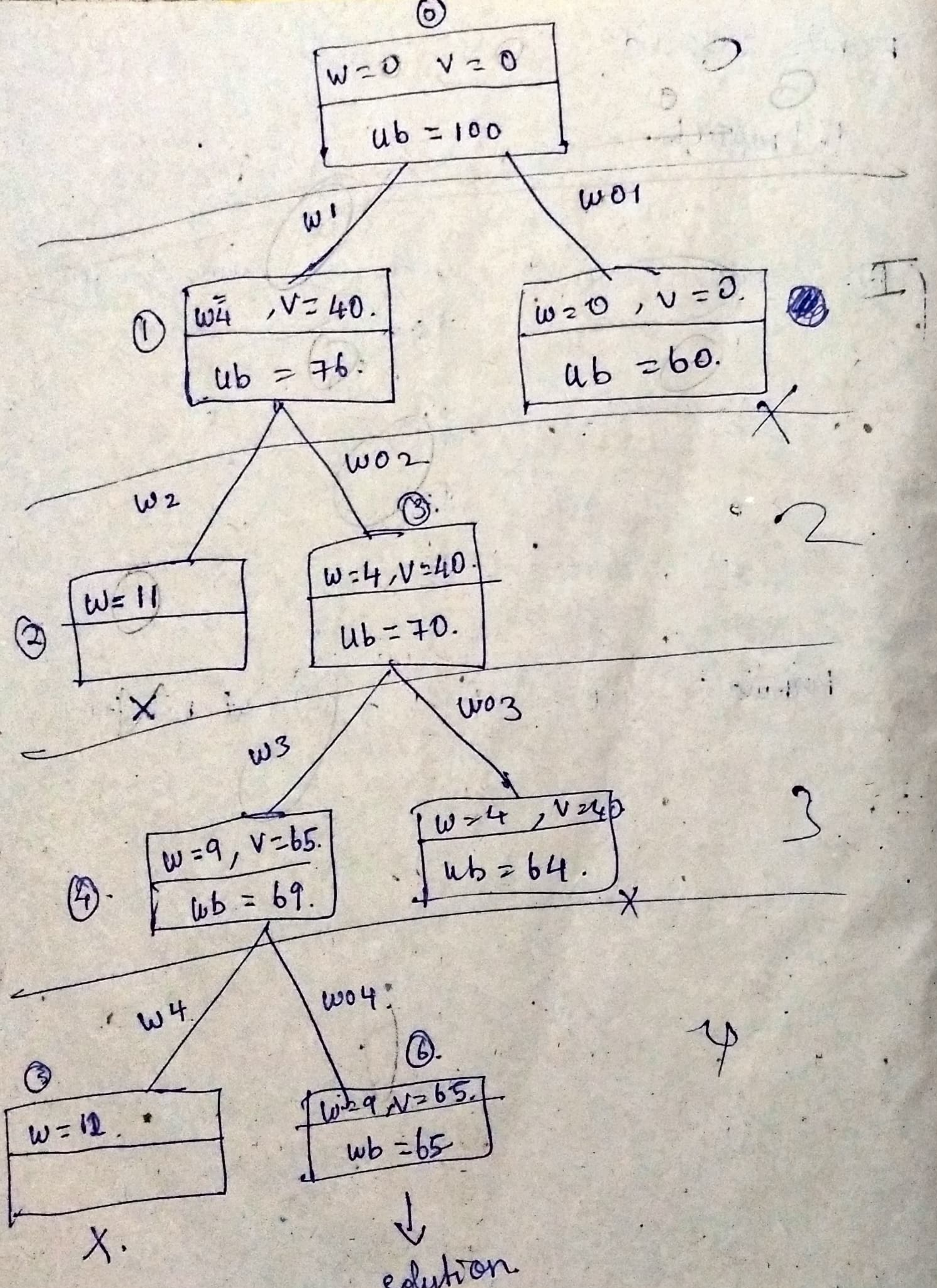
| s.no | weight | value | value / weight |
|---|---|---|---|
| 1 | 4 | \$40 | 10 |
| 2 | 7 | \$42 | 6 |
| 3 | 5 | \$25 | 5 |
| 4 | 3 | \$12 | 4 |

$\frac{40}{4}$ 10

Formula: $UB = V + (W - w)(v_{i+1} / w_{(i+1)})$

$UB = V + (W - w)(v_{(i+1)} / w_{(i+1)})$

$V + (W - w)(V_{(i+1)} / w_{(i+1)})$



0
w=0 v=0
ub=100
w1
w01
1
w=4, V=40.
ub = 76.
w=0, v=0.
ub =60.
I
X
w2
w02
3.
2
2
w=11
X
w=4, V=40.
ub=70.
w3
w03
3
4.
w=9, V=65.
ub = 69.
w=4, V=40
ub=64.
X
w4
w04
4
5
w=12.
X.
6.
w=9 V=65.
ub=65
solution.

Node 0 :-

$\boxed{I = 0,\ w = 0,\ v = 0.}$ $W = 10$

$ub = v + (W - w)\,(v_{(i+1)} / w_{(i+1)})$.

$= 0 + (10 - 0)\,(10)$

$= 100.$

Node ①:

$I = 1,\quad W = 4,\quad V = 40.$

$ub = v + (W - w)\,(v_{(i+1)} / w_{(i+1)})$.

$= 40 + (10 - 4)\,(6).$

$= 40 + 6 = 40 + (6 \times 6) = \underline{76}.$

Node 3 :

$I = 2,\ W = 4,\ V = 40.$

$ub = v + (W - w)\,(v_{(i+1)} / w_{(i+1)})$.

$= 40 + (10 - 4)\,(5).$

$= 40 + 30 = 70.$

node 4:

$v = 65, \quad w = 9, \quad I = 3.$

$ub = V + (W - w)(v_{(i+1)} / w_{(i+1)}).$

$= 65 + (10 - 9)(4).$

$= 69.$

node 6:

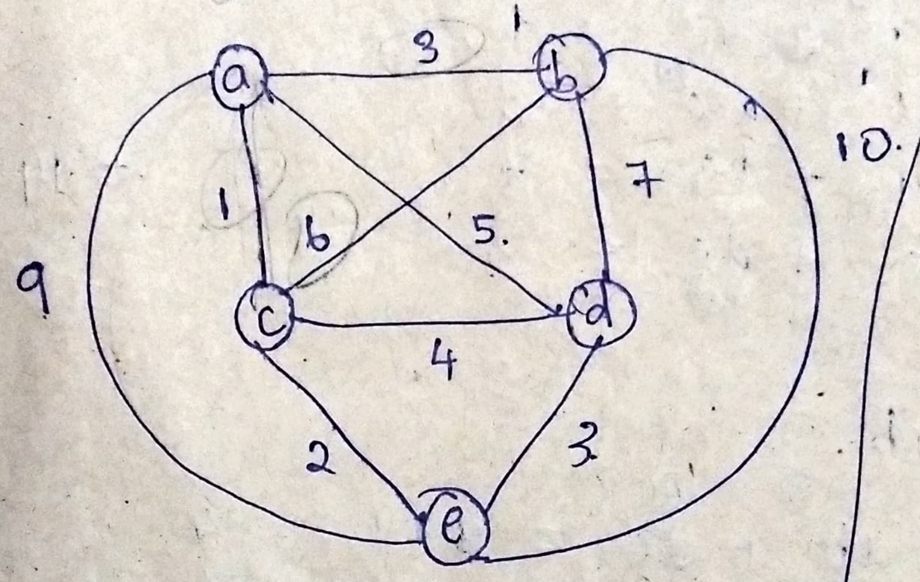
$v = 65, \quad w = 9, \quad I = 4.$

$ub = v + (W - w)(v_{(i+1)} / w_{(i+1)})$

$= 65 + (1)(0)$

$= 65.$

2) Travelling Salesman problem:




$a \to ac + ab = 3 + 1 = 4$

$b \to ab + ac =$

$c \to$

$d \to$

$e \to$

$b \to d.$

$b \to c$

$a - b$

$a \to c$

$a \to d.$

$a \to e.$

---

$a \to b \to c$

$a \to b \to d.$

$a \to b \to e.$

---

$a \to b \to c \to d.$

$a \to b \to c \to e.$

---

$a \to b \to c \to d \to e.$

Node 0:

$a \to ac + ab = 4$

$b \to ab + ac = 9$

$c \to ac + ae = 3$

$d \to cd + de = 7$

$e \to ce + de = 5$

$4+9+3+7+2 = \frac{28}{2}$

$= 14$

Node 1: $\boxed{a \to b}$

$a \to ab + ac = 3+1 = 4$

$b \to ab + bc = 3+6 = 9$

$c \to ac + ce = 3$

$d \to cd + de = 7$

$e \to ce + de = 5$

$= 14$

Node 2: $a \to c$

$a \to ac + ab = 3+1 = 4$

$b \to ab + ac = 9$

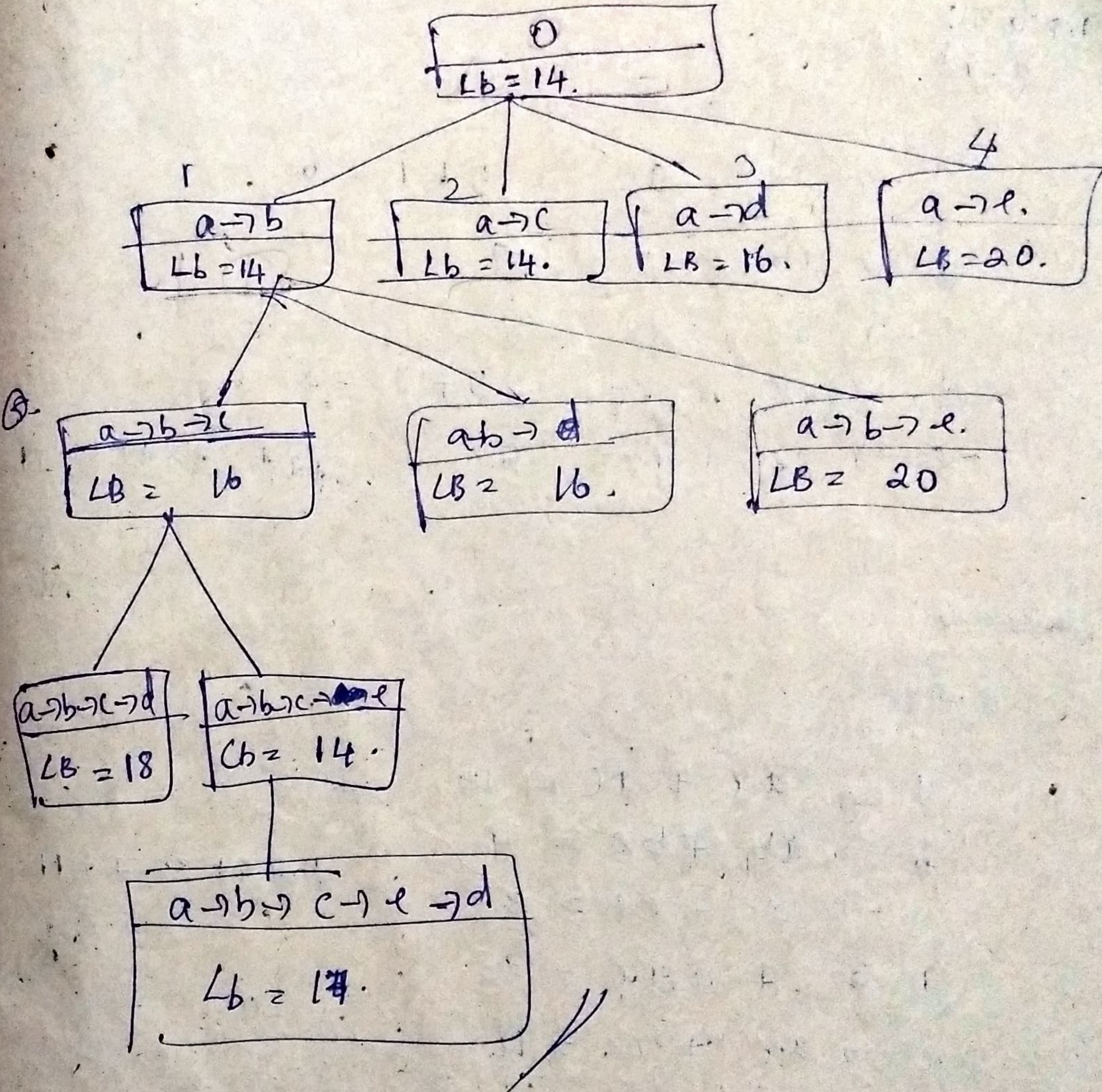
$c \to ac + ce = 1+2 = 3$

$d \to cd + de = 7$

$e \to ce + de = 5$

$4+9+3+7+5 = \frac{28}{2}$

$= 14$


0
Lb = 14.
1
a→b
Lb = 14
2
a→c
Lb = 14.
3
a→d
LB = 16.
4
a→e.
LB = 20.
a→b→c
LB = 16
a→b→d
LB = 16.
a→b→e.
LB = 20
a→b→c→d
LB = 18
a→b→c→e
Lb = 14.
a→b→c→e→d
Lb = 17.

Node 3:

$a \to d$.

$a \to ad + ac = 5 + 1 = 6.$

$b \to ab + ac = 9$

$c \to ac + ce = 3$

$d \to ad + ed = 5 + 3 = 8.$

$e \to ce + de = 5.$

$6 + 9 + 3 + 8 + 5 = 31/2$

$= 15.5$

$= 16.$

Node 4:

$a \to e$.

$a \to ae + ac = 10$

$b \to ab + bc = 9$

$c \to ae + ce = 3.$

$d \to cd + de = 7$

$e \to ae + ce = 11.$

$10 + 9 + 3 + 7 + 11.$

$= 40/2$

$= 20..$

Node 5 : $a \to b \to c$ . , ac, be.

$a \to ac + ab = 4$
$b \to bc + ab = 9$
$c \to \boxed{ac + bc} = 7$
$d \to ce + de = 5$ (16).
$e \to ce + de = 5$.

Node 6 : $a \to b \to d$. $\Rightarrow$ ab, bd

$a \to ab + bc = 4$
$b \to ab + bd = 10$ = (16).
$c \to ac + ce = 3$
$d \to bd + de = 10$.
$e \to ce + dc = 5$.

Node 7 : $a \to b \to e$. $\Rightarrow$ ab, be.

$a \to ae + dc = 4$
$b \to ba + be = 13$
$c \to ac + ce = 3$ = 20://
$d \to cd + de = 7$
$e \to$ ~~[illegible]~~ $be + ee = 12$

Node 8 : a → b → c → d. ⇒ ab, bc, cd.

a → ab + ac = 4
b → ab + bc = 9
c → bc + cd = 10
d → cd + de = 7
e → ce + de = 5.

35/2.

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Node 9 :
a → b → c → e. ab, bc, ce.

a → ab + ac = 4
b → ab + bc = 9
c → bc + ce = 8
d → cd + de = 7
e → ce + de = 5.

14.

Node 10 : a → b → c → e → d. ab, bc, ce, ed.

a → ab + ac = 4
b → ab + bc = 9
c → bc + ce = 8
d → ed + de = 7
e → ce + ed = 5

10.5

17