eisenberg-noe-2001-debt-model-with-default-costs

November 13, 2021

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DEBT MODEL WITH DEFAULT COSTS

ALPHA = 0.1 and BETA = 0.9
Running Debt Model in MANUAL mode with 3 nodes…

Scenario 5 - Firm B defaults in first round, Firm A in second round, algorithm
terminates round 3, MODE == 'MANUAL', NUM_AGENTS = 3, NOMINAL_LIABILITY_MATRIX =
np.array([[0,2,9],[7,0,9],[3,1,0]]), OPERATING_CASH_FLOW_VECTOR = [3, 0, 4],
ALPHA = 0.1, BETA = 0.9

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AGENT LABELS

Agent labels ['A', 'B', 'C']

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NOMINAL LIABILITY MATRIX Data Frame
i.e. what node i expects to pay node j…

   A  B  C
A  0  2  9
B  7  0  9
C  3  1  0



Nominal liabilities for each node:
Liability of Node A to Node B is 2
Liability of Node A to Node C is 9
Liability of Node B to Node A is 7
Liability of Node B to Node C is 9
Liability of Node C to Node A is 3
Liability of Node C to Node B is 1

NOMINAL LIABILITY MATRIX TRANSPOSED Data Frame
```

i.e. what node j expects to receive from i…

	A	B	C
A	0	7	3
B	2	0	1
C	9	9	0

Node A expects to receive 7 from Node B
Node A expects to receive 3 from Node C
Node B expects to receive 2 from Node A
Node B expects to receive 1 from Node C
Node C expects to receive 9 from Node A
Node C expects to receive 9 from Node B

OPERATING CASH FLOW VECTOR

Exogenous cash flow for Node A: 3
Exogenous cash flow for Node B: 0
Exogenous cash flow for Node C: 4
[3, 0, 4]

CALCULATING RELATIVE LIABILITIES FOR EACH NODE

Node A

- Liabilities for Node A
Liability of Node A to Node B (i.e. P_01) is 2.0
Liability of Node A to Node C (i.e. P_02) is 9.0

- Total obligations for Node A
Total Obligation Vector updated in round 1 for Node A with value 11.0
Total nominal liabilities for Node A (i.e. p_bar_1) is 11.0

- Relative Liabilities of Node A
Relative Liability of Node A to Node B is 0.18181818181818182
Relative Liability of Node A to Node C is 0.8181818181818182
Sum of Relative Liabilities for Node A is 1.0

Node B

- Liabilities for Node B
Liability of Node B to Node A (i.e. P_10) is 7.0
Liability of Node B to Node C (i.e. P_12) is 9.0

```
- Total obligations for Node B
Total Obligation Vector updated in round 1 for Node B with value 16.0
Total nominal liabilities for Node B (i.e. p_bar_2) is 16.0

- Relative Liabilities of Node B
Relative Liability of Node B to Node A is 0.4375
Relative Liability of Node B to Node C is 0.5625
Sum of Relative Liabilities for Node B is 1.0

***Node C***

- Liabilities for Node C
Liability of Node C to Node A (i.e. P_20) is 3.0
Liability of Node C to Node B (i.e. P_21) is 1.0

- Total obligations for Node C
Total Obligation Vector updated in round 1 for Node C with value 4.0
Total nominal liabilities for Node C (i.e. p_bar_3) is 4.0

- Relative Liabilities of Node C
Relative Liability of Node C to Node A is 0.75
Relative Liability of Node C to Node B is 0.25
Sum of Relative Liabilities for Node C is 1.0

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RELATIVE LIABILITY MATRIX Data Frame

        A         B         C
A  0.0000  0.181818  0.818182
B  0.4375  0.000000  0.562500
C  0.7500  0.250000  0.000000



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RELATIVE LIABILITY MATRIX Data Frame SANITY CHECK

        A         B         C  Relative Liability Total  CORRECT VALUE?
A  0.0000  0.181818  0.818182                       1.0            True
B  0.4375  0.000000  0.562500                       1.0            True
C  0.7500  0.250000  0.000000                       1.0            True



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RELATIVE LIABILITY MATRIX TRANSPOSED Data Frame
i.e. what node i expects to receive from j in relative terms…
```

```
          A       B     C
A  0.000000  0.4375  0.75
B  0.181818  0.0000  0.25
C  0.818182  0.5625  0.00


***Expected nominal payments in for Node A - both proportion and total amount***

Node A expects to receive proportion 0.4375 from Node B
Node A expects to receive proportion 0.75 from Node C
Total payments in to Node A is 10.0

***Expected nominal payments in for Node B - both proportion and total amount***

Node B expects to receive proportion 0.18181818181818182 from Node A
Node B expects to receive proportion 0.25 from Node C
Total payments in to Node B is 3.0

***Expected nominal payments in for Node C - both proportion and total amount***

Node C expects to receive proportion 0.8181818181818182 from Node A
Node C expects to receive proportion 0.5625 from Node B
Total payments in to Node C is 18.0

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START OF ROUND 1

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TOTAL OBLIGATION VECTOR

i.e. total nominal obligations for each node i.e. p_bar_i…
Total nominal obligation for Node A (i.e. p_bar_1): 11.0
Total nominal obligation for Node B (i.e. p_bar_2): 16.0
Total nominal obligation for Node C (i.e. p_bar_3): 4.0

------------------------------------------------------------

TOTAL PAYMENT MADE PER NODE

i.e. min[nominal obligations, cashflow (payments in + exogenous cash flow)] for
each node…
```

```
***Node A***

- Total payments in for Node A
Total payments in to Node A is 10.0

- Liabilities for Node A
Liability of Node A to Node B (i.e. P_01) is 2.0
Liability of Node A to Node C (i.e. P_02) is 9.0

- Total obligations for Node A
Total nominal liabilities for Node A (i.e. p_bar_1) is 11.0
Payment out is min[payment out, total cash flow] i.e. min[11.0, 13.0]

 - Total Dollar Payment Vector for round 1 and Node A
Total Dollar Payment Vector for round 1 and Node A updated with value 11.0

***Node B***

- Total payments in for Node B
Total payments in to Node B is 3.0

- Liabilities for Node B
Liability of Node B to Node A (i.e. P_10) is 7.0
Liability of Node B to Node C (i.e. P_12) is 9.0

- Total obligations for Node B
Total nominal liabilities for Node B (i.e. p_bar_2) is 16.0
Payment out is min[payment out, total cash flow] i.e. min[16.0, 3.0]
Total payments in to Node B is 3.0
Total payments in to Node B is 3.0
Total payments in to Node B is 3.0
Round 1 and Node B has defaulted due to nominal obligations 16.0 being greater
than cash flow 3.0. Default loss for Node B is 0.2999999999999998

 - Total Dollar Payment Vector for round 1 and Node B
Total Dollar Payment Vector for round 1 and Node B updated with value 2.7

***Node C***

- Total payments in for Node C
Total payments in to Node C is 18.0

- Liabilities for Node C
Liability of Node C to Node A (i.e. P_20) is 3.0
Liability of Node C to Node B (i.e. P_21) is 1.0

- Total obligations for Node C
Total nominal liabilities for Node C (i.e. p_bar_3) is 4.0
```

```
Payment out is min[payment out, total cash flow] i.e. min[4.0, 22.0]

 - Total Dollar Payment Vector for round 1 and Node C
Total Dollar Payment Vector for round 1 and Node C updated with value 4.0

-----------------------------------------------------

TOTAL PAYMENT VECTOR

Total payment by Node A (i.e. p_1): 11.0
Total payment by Node B (i.e. p_2): 2.7
Total payment by Node C (i.e. p_3): 4.0
[11.0, 2.7, 4.0]

-----------------------------------------------------

UPDATE EQUITY (i.e. BOOK VALUE) FOR EACH NODE

Total payments in to Node A is 10.0
Total dollar payment by Node A (i.e. p_1) is 11.0

 - Equity Vector for round 1 and Node A
Equity Vector for round 1 and Node A updated with value 13.0
Total payments in to Node B is 3.0
Total dollar payment by Node B (i.e. p_2) is 2.7

 - Equity Vector for round 1 and Node B
Equity Vector for round 1 and Node B updated with value 3.0
Total payments in to Node C is 18.0
Total dollar payment by Node C (i.e. p_3) is 4.0

 - Equity Vector for round 1 and Node C
Equity Vector for round 1 and Node C updated with value 22.0

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EQUITY FOR EACH NODE

Equity for Node A: 13.0
Equity for Node B: 3.0
Equity for Node C: 22.0
[13.0, 3.0, 22.0]

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ROUND 1 DEFAULTERS

Node B has defaulted in round 1
```

```
{'A': False, 'B': True, 'C': False}
There are defaulters in this round (i.e. round 1), algorithm will proceed for
another round.

------------------------------------------------------------

END OF ROUND 1

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START OF ROUND 2

------------------------------------------------------------

TOTAL OBLIGATION VECTOR

i.e. total nominal obligations for each node i.e. p_bar_i…
Total nominal obligation for Node A (i.e. p_bar_1): 11.0
Total nominal obligation for Node B (i.e. p_bar_2): 16.0
Total nominal obligation for Node C (i.e. p_bar_3): 4.0

------------------------------------------------------------

TOTAL PAYMENT MADE PER NODE

i.e. min[nominal obligations, cashflow (payments in + exogenous cash flow)] for
each node…

***Node A***

- Total payments in for Node A
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125

- Liabilities for Node A
Liability of Node A to Node B (i.e. P_01) is 2.0
Liability of Node A to Node C (i.e. P_02) is 9.0
Total nominal liabilities for Node A (i.e. p_bar_1) is 11.0
Payment out is min[payment out, total cash flow] i.e. min[11.0, 7.18125]
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125
Relative Payment in to Node A from Node B is 0.4375
```

```
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125
Round 2 and Node A has defaulted due to nominal obligations 11.0 being greater
than cash flow 7.18125. Default loss for Node A is 3.118125

 - Total Dollar Payment Vector for round 2 and Node A
Total Dollar Payment Vector for round 2 and Node A updated with value 4.063125

***Node B***

- Total payments in for Node B
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 11.0
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 3.0

- Liabilities for Node B
Liability of Node B to Node A (i.e. P_10) is 7.0
Liability of Node B to Node C (i.e. P_12) is 9.0
Total nominal liabilities for Node B (i.e. p_bar_2) is 16.0
Payment out is min[payment out, total cash flow] i.e. min[16.0, 3.0]
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 11.0
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 3.0
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 11.0
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 3.0
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 11.0
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 3.0
Round 2 and Node B has defaulted due to nominal obligations 16.0 being greater
than cash flow 3.0. Default loss for Node B is 0.2999999999999998

 - Total Dollar Payment Vector for round 2 and Node B
```

```
Total Dollar Payment Vector for round 2 and Node B updated with value 2.7

***Node C***

- Total payments in for Node C
Relative Payment in to Node C from Node A is 0.8181818181818182
Total dollar payment by Node A (i.e. p_1) is 11.0
Relative Payment in to Node C from Node B is 0.5625
Total dollar payment by Node B (i.e. p_2) is 2.7
Total payments in to Node C is 10.51875

- Liabilities for Node C
Liability of Node C to Node A (i.e. P_20) is 3.0
Liability of Node C to Node B (i.e. P_21) is 1.0
Total nominal liabilities for Node C (i.e. p_bar_3) is 4.0
Payment out is min[payment out, total cash flow] i.e. min[4.0, 14.51875]

 - Total Dollar Payment Vector for round 2 and Node C
Total Dollar Payment Vector for round 2 and Node C updated with value 4.0

----------------------------------------------------------

TOTAL PAYMENT VECTOR

Total payment by Node A (i.e. p_1): 4.063125
Total payment by Node B (i.e. p_2): 2.7
Total payment by Node C (i.e. p_3): 4.0
[4.063125, 2.7, 4.0]

----------------------------------------------------------

UPDATE EQUITY (i.e. BOOK VALUE) FOR EACH NODE

Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125
Total dollar payment by Node A (i.e. p_1) is 4.063125

 - Equity Vector for round 2 and Node A
Equity Vector for round 2 and Node A updated with value 7.18125
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 11.0
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 3.0
Total dollar payment by Node B (i.e. p_2) is 2.7
```

```
 - Equity Vector for round 2 and Node B
Equity Vector for round 2 and Node B updated with value 3.0
Relative Payment in to Node C from Node A is 0.8181818181818182
Total dollar payment by Node A (i.e. p_1) is 11.0
Relative Payment in to Node C from Node B is 0.5625
Total dollar payment by Node B (i.e. p_2) is 2.7
Total payments in to Node C is 10.51875
Total dollar payment by Node C (i.e. p_3) is 4.0

 - Equity Vector for round 2 and Node C
Equity Vector for round 2 and Node C updated with value 14.51875

-----------------------------------------------------

EQUITY FOR EACH NODE

Equity for Node A: 7.18125
Equity for Node B: 3.0
Equity for Node C: 14.51875
[7.18125, 3.0, 14.51875]

-----------------------------------------------------

ROUND 2 DEFAULTERS

Node A has defaulted in round 2
{'A': True, 'B': True, 'C': False}
There are defaulters in this round (i.e. round 2), algorithm will proceed for
another round.

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END OF ROUND 2

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START OF ROUND 3

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TOTAL OBLIGATION VECTOR

i.e. total nominal obligations for each node i.e. p_bar_i…
Total nominal obligation for Node A (i.e. p_bar_1): 11.0
Total nominal obligation for Node B (i.e. p_bar_2): 16.0
Total nominal obligation for Node C (i.e. p_bar_3): 4.0
```

```
-------------------------------------------------------

TOTAL PAYMENT MADE PER NODE

i.e. min[nominal obligations, cashflow (payments in + exogenous cash flow)] for
each node…

***Node A***

- Total payments in for Node A
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125

- Liabilities for Node A
Liability of Node A to Node B (i.e. P_01) is 2.0
Liability of Node A to Node C (i.e. P_02) is 9.0
Total nominal liabilities for Node A (i.e. p_bar_1) is 11.0
Payment out is min[payment out, total cash flow] i.e. min[11.0, 7.18125]
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125
Round 3 and Node A has defaulted due to nominal obligations 11.0 being greater
than cash flow 7.18125. Default loss for Node A is 3.118125

 - Total Dollar Payment Vector for round 3 and Node A
Total Dollar Payment Vector for round 3 and Node A updated with value 4.063125

***Node B***

- Total payments in for Node B
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node B from Node C is 0.25
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```
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 1.73875

- Liabilities for Node B
Liability of Node B to Node A (i.e. P_10) is 7.0
Liability of Node B to Node C (i.e. P_12) is 9.0
Total nominal liabilities for Node B (i.e. p_bar_2) is 16.0
Payment out is min[payment out, total cash flow] i.e. min[16.0, 1.73875]
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 1.73875
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 1.73875
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 1.73875
Round 3 and Node B has defaulted due to nominal obligations 16.0 being greater
than cash flow 1.73875. Default loss for Node B is 0.173875

 - Total Dollar Payment Vector for round 3 and Node B
Total Dollar Payment Vector for round 3 and Node B updated with value 1.564875

***Node C***

- Total payments in for Node C
Relative Payment in to Node C from Node A is 0.8181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node C from Node B is 0.5625
Total dollar payment by Node B (i.e. p_2) is 2.7
Total payments in to Node C is 4.843125000000001

- Liabilities for Node C
Liability of Node C to Node A (i.e. P_20) is 3.0
Liability of Node C to Node B (i.e. P_21) is 1.0
Total nominal liabilities for Node C (i.e. p_bar_3) is 4.0
Payment out is min[payment out, total cash flow] i.e. min[4.0, 8.843125]

 - Total Dollar Payment Vector for round 3 and Node C
Total Dollar Payment Vector for round 3 and Node C updated with value 4.0

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```
TOTAL PAYMENT VECTOR

Total payment by Node A (i.e. p_1): 4.063125
Total payment by Node B (i.e. p_2): 1.564875
Total payment by Node C (i.e. p_3): 4.0
[4.063125, 1.564875, 4.0]

-----------------------------------------------------

UPDATE EQUITY (i.e. BOOK VALUE) FOR EACH NODE

Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125
Total dollar payment by Node A (i.e. p_1) is 4.063125

 - Equity Vector for round 3 and Node A
Equity Vector for round 3 and Node A updated with value 7.18125
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 1.73875
Total dollar payment by Node B (i.e. p_2) is 1.564875

 - Equity Vector for round 3 and Node B
Equity Vector for round 3 and Node B updated with value 1.73875
Relative Payment in to Node C from Node A is 0.8181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node C from Node B is 0.5625
Total dollar payment by Node B (i.e. p_2) is 2.7
Total payments in to Node C is 4.843125000000001
Total dollar payment by Node C (i.e. p_3) is 4.0

 - Equity Vector for round 3 and Node C
Equity Vector for round 3 and Node C updated with value 8.843125

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EQUITY FOR EACH NODE

Equity for Node A: 7.18125
Equity for Node B: 1.73875
Equity for Node C: 8.843125
[7.18125, 1.73875, 8.843125]
```

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ROUND 3 DEFAULTERS

Node A has defaulted in round 3
{'A': True, 'B': True, 'C': False}
There are defaulters from earlier rounds but no new defaulters in the current
round, algorithm will not proceed for another round.

***Checking limited liability and absolute priority for Node A***

Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125

- Limited liability is met. Node A made a payment of 4.063125 in round 3 which
is less than or equal to the cash flow (payments in + exogenous cash) of
7.18125.
Total nominal obligation for Node A (i.e. p_bar_1): 11.0
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node A from Node B is 0.4375
Total dollar payment by Node B (i.e. p_2) is 2.7
Relative Payment in to Node A from Node C is 0.75
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node A is 4.18125

 -Checking absolute priority for Node A in round 3. Nominal obligations is 11.0
and Dollar payments is 4.063125
Dollar payments less than nominal obligations. Now checking if all value is paid
to creditors, i.e. Total cash flow for Node A
All value i.e. cash flow available to Node A is 7.18125
-Absolute priority is satisfied for Node A

- Absolute priority is met by Node A in round 3 i.e. either obligations are paid
in full or all available cash flow (i.e. sum of the payments received by the
node plus the exogenous operating cash flow) is paid to creditors. Nominal
obligations were 11.0,  Dollar payment was 4.063125 and Total cash flow was
7.18125

Node A in round 3 passes candidate clearing vector payment entry checks.

***Checking limited liability and absolute priority for Node B***

Total dollar payment by Node B (i.e. p_2) is 1.564875
```

```
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 1.73875

- Limited liability is met. Node B made a payment of 1.564875 in round 3 which
is less than or equal to the cash flow (payments in + exogenous cash) of
1.73875.
Total nominal obligation for Node B (i.e. p_bar_2): 16.0
Total dollar payment by Node B (i.e. p_2) is 1.564875
Relative Payment in to Node B from Node A is 0.18181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node B from Node C is 0.25
Total dollar payment by Node C (i.e. p_3) is 4.0
Total payments in to Node B is 1.73875

 -Checking absolute priority for Node B in round 3. Nominal obligations is 16.0
and Dollar payments is 1.564875
Dollar payments less than nominal obligations. Now checking if all value is paid
to creditors, i.e. Total cash flow for Node B
All value i.e. cash flow available to Node B is 1.73875
-Absolute priority is satisfied for Node B

- Absolute priority is met by Node B in round 3 i.e. either obligations are paid
in full or all available cash flow (i.e. sum of the payments received by the
node plus the exogenous operating cash flow) is paid to creditors. Nominal
obligations were 16.0,  Dollar payment was 1.564875 and Total cash flow was
1.73875

Node B in round 3 passes candidate clearing vector payment entry checks.

***Checking limited liability and absolute priority for Node C***

Total dollar payment by Node C (i.e. p_3) is 4.0
Relative Payment in to Node C from Node A is 0.8181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node C from Node B is 0.5625
Total dollar payment by Node B (i.e. p_2) is 2.7
Total payments in to Node C is 4.843125000000001

- Limited liability is met. Node C made a payment of 4.0 in round 3 which is
less than or equal to the cash flow (payments in + exogenous cash) of 8.843125.
Total nominal obligation for Node C (i.e. p_bar_3): 4.0
Total dollar payment by Node C (i.e. p_3) is 4.0
Relative Payment in to Node C from Node A is 0.8181818181818182
Total dollar payment by Node A (i.e. p_1) is 4.063125
Relative Payment in to Node C from Node B is 0.5625
```

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Total dollar payment by Node B (i.e. p_2) is 2.7
Total payments in to Node C is 4.843125000000001

 -Checking absolute priority for Node C in round 3. Nominal obligations is 4.0
and Dollar payments is 4.0
-Absolute priority is satisfied for Node C

- Absolute priority is met by Node C in round 3 i.e. either obligations are paid
in full or all available cash flow (i.e. sum of the payments received by the
node plus the exogenous operating cash flow) is paid to creditors. Nominal
obligations were 4.0,  Dollar payment was 4.0 and Total cash flow was 8.843125

Node C in round 3 passes candidate clearing vector payment entry checks.

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CLEARING_PAYMENT_VECTOR

Clearing payment vector found in round 3.
[4.063125, 1.564875, 4.0]
Node A pays: 4.063125
Node B pays: 1.564875
Node C pays: 4.0
Default loss incurred by Node A is: 3.118125
Default loss incurred by Node B is: 0.173875
Default loss incurred by Node C is: 0

-----------------------------------------------------------

END OF ROUND 3
- Systemic Risk: Node B has defaulted in round 1. The number of prior default
waves is 0. There are 3 nodes in the system (0 of which have defaulted i.e. []).
- Systemic Risk: Node A has defaulted in round 2. The number of prior default
waves is 1. There are 3 nodes in the system (1 of which have defaulted i.e.
['B']).
- Systemic Risk: Node C has not defaulted after 3 rounds. There are 3 nodes in
the  system (2 of which have defaulted i.e. ['B', 'A']).


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Scenario 5 - Firm B defaults in first round, Firm A in second round, algorithm
terminates round 3, MODE == 'MANUAL', NUM_AGENTS = 3, NOMINAL_LIABILITY_MATRIX =
np.array([[0,2,9],[7,0,9],[3,1,0]]), OPERATING_CASH_FLOW_VECTOR = [3, 0, 4],
ALPHA = 0.1, BETA = 0.9

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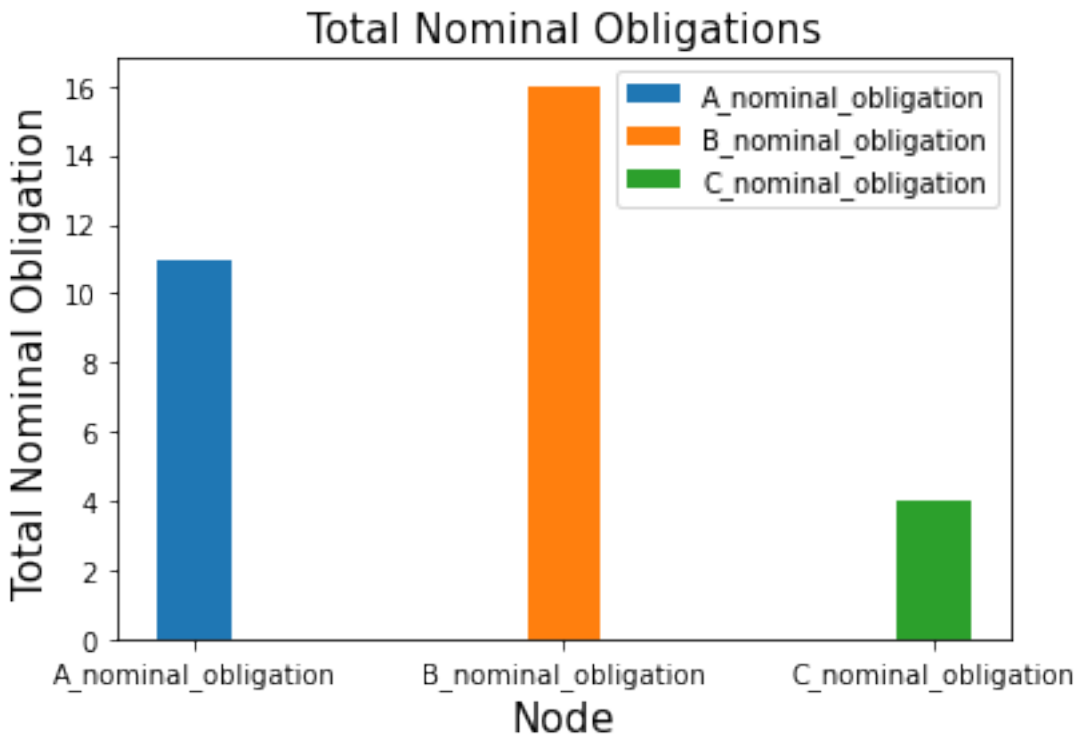
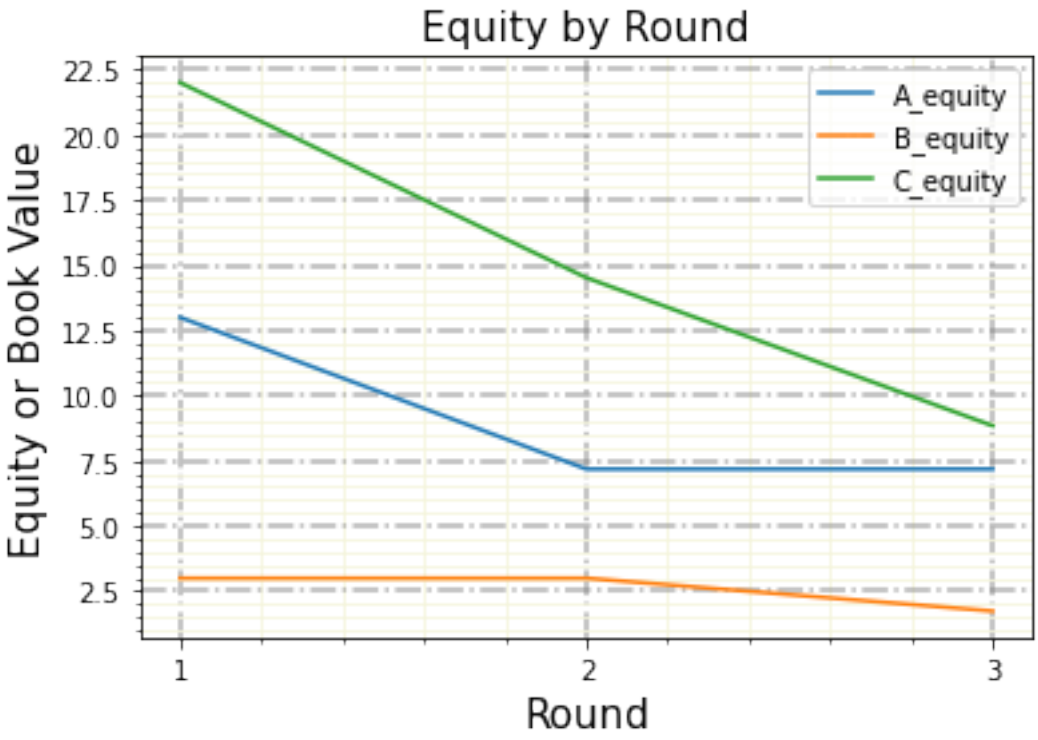
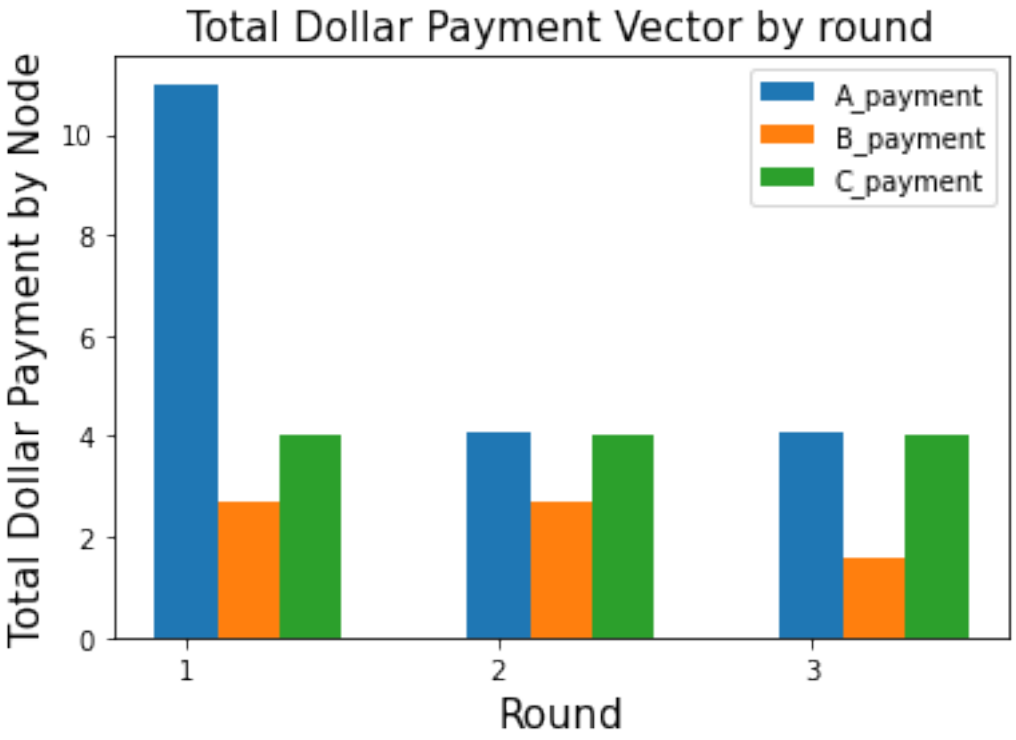
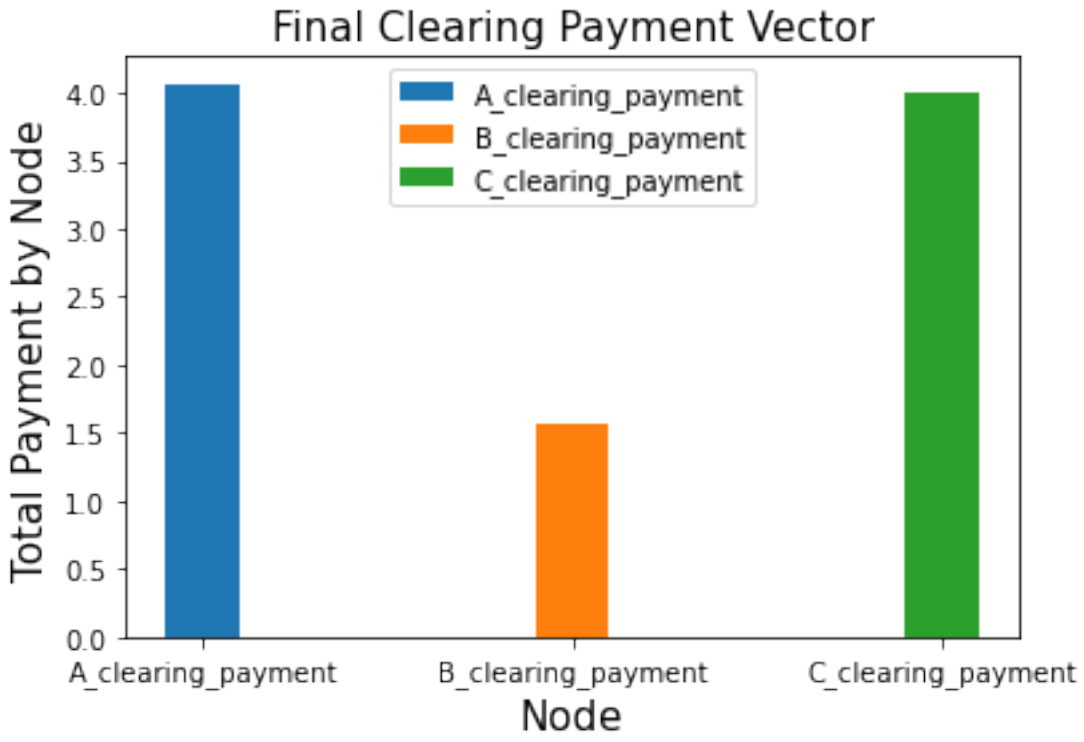
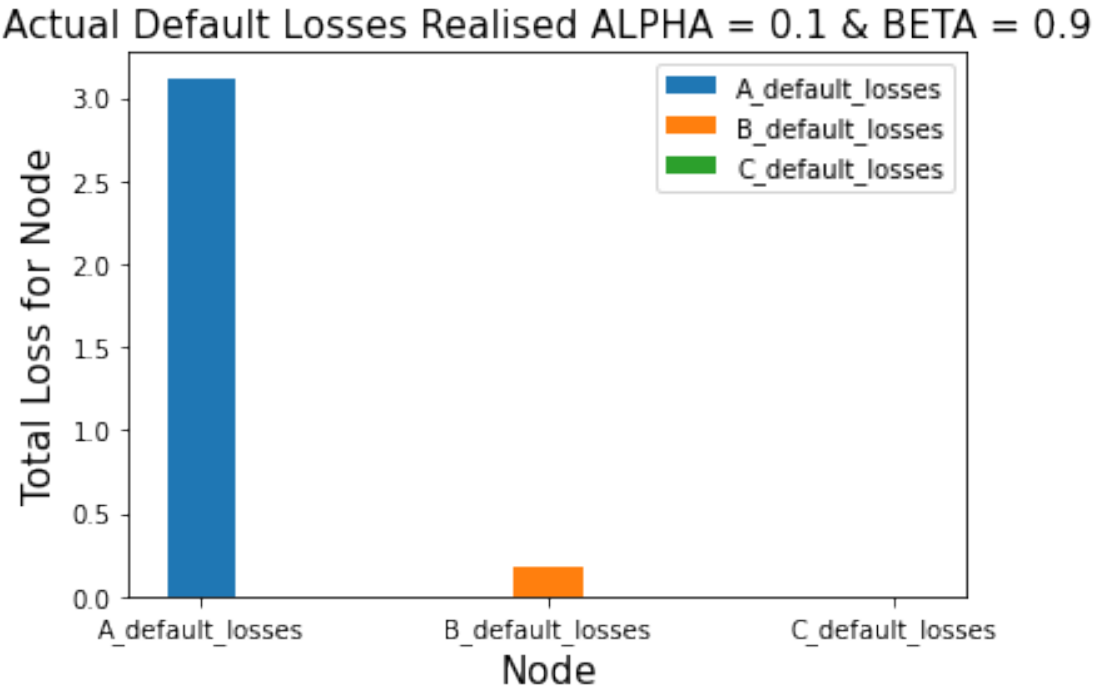
```


Total Nominal Obligations
Total Nominal Obligation
16
14
12
10
8
6
4
2
0
A_nominal_obligation
B_nominal_obligation
C_nominal_obligation
A_nominal_obligation
B_nominal_obligation
C_nominal_obligation
Node

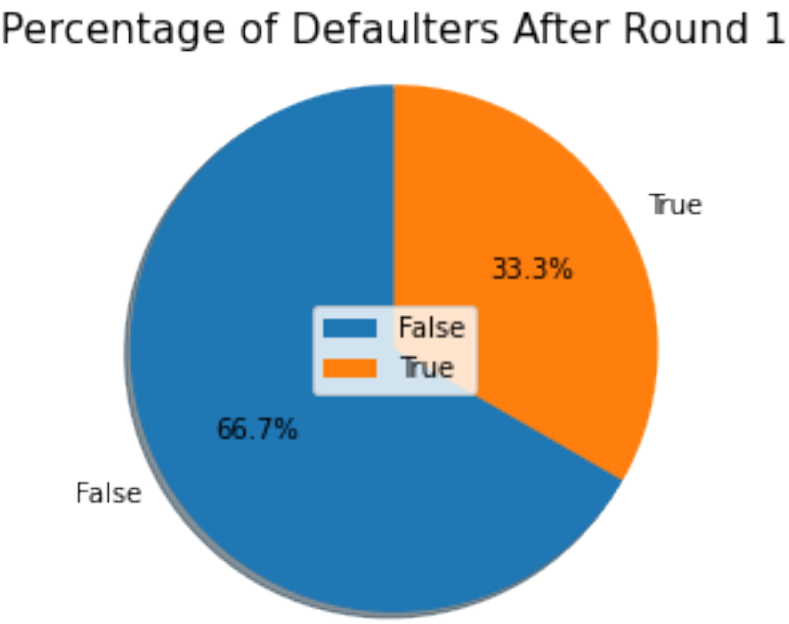

Equity by Round
Equity or Book Value
Round
A_equity
B_equity
C_equity
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
1
2
3


Total Dollar Payment Vector by round
Total Dollar Payment by Node
Round
A_payment
B_payment
C_payment
0
2
4
6
8
10
1
2
3

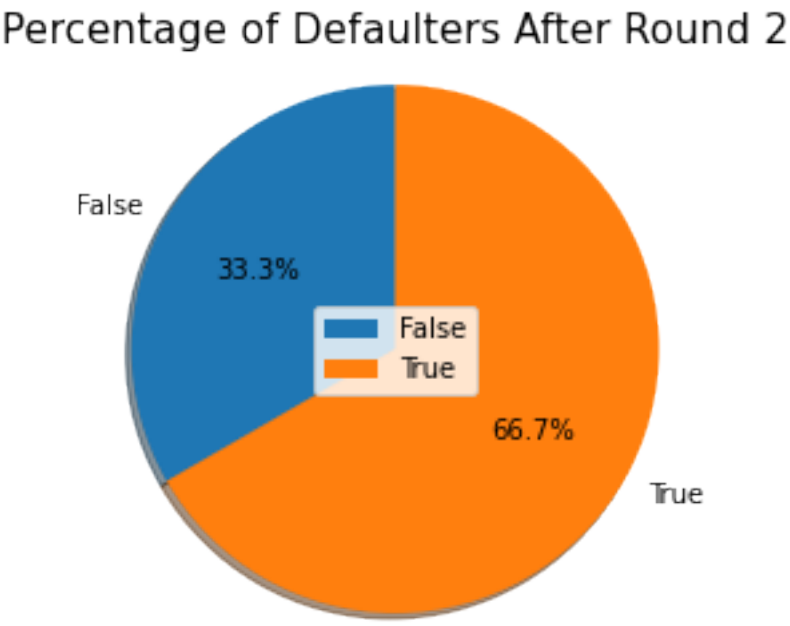

Final Clearing Payment Vector
A_clearing_payment
B_clearing_payment
C_clearing_payment
Total Payment by Node
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
A_clearing_payment
B_clearing_payment
C_clearing_payment
Node


Actual Default Losses Realised ALPHA = 0.1 & BETA = 0.9
A_default_losses
B_default_losses
C_default_losses
Total Loss for Node
3.0
2.5
2.0
1.5
1.0
0.5
0.0
A_default_losses
B_default_losses
C_default_losses
Node

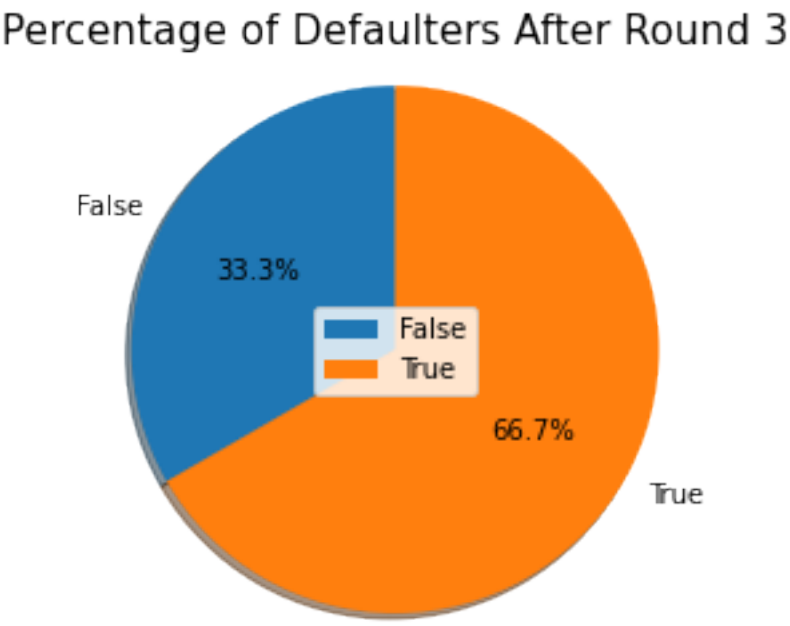
ALPHA and BETA are the fraction of exogenous assets (outside financial network) and endogenous assets (inside financial network i.e. interbank obligations) that are realised on liquidation in the event of default. The two fractions may conceivably be different; we would typically expect that ALPHA would be low,because the bank would be having to sell off its loan portfolio, probably at a knock-down price or fire sale. In contrast, BETA might be much closer to 1, because an obligation from a solvent bank would probably be paid in full (though perhaps with some negotiated discount to compensate for the inconvenience of early repayment).



Node A has NOT defaulted in round 1
Node B has defaulted in round 1
Node C has NOT defaulted in round 1




```
Node A has defaulted in round 2
Node B has defaulted in round 2
Node C has NOT defaulted in round 2
```




```
Node A has defaulted in round 3
```

```
Node B has defaulted in round 3
Node C has NOT defaulted in round 3

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