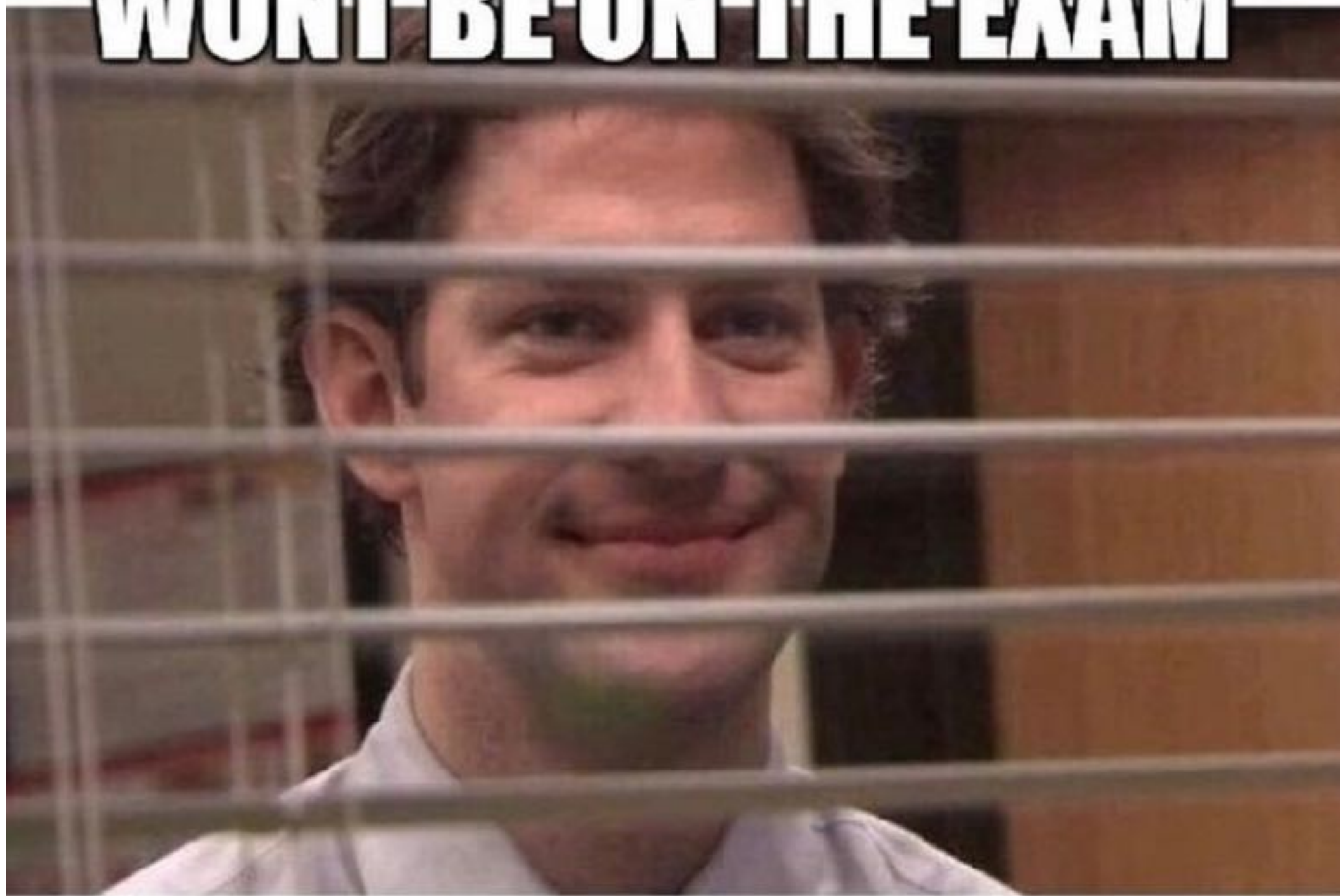


**"THIS QUESTION
WONT BE ON THE EXAM"**



THAT QUESTION

What can you bring?

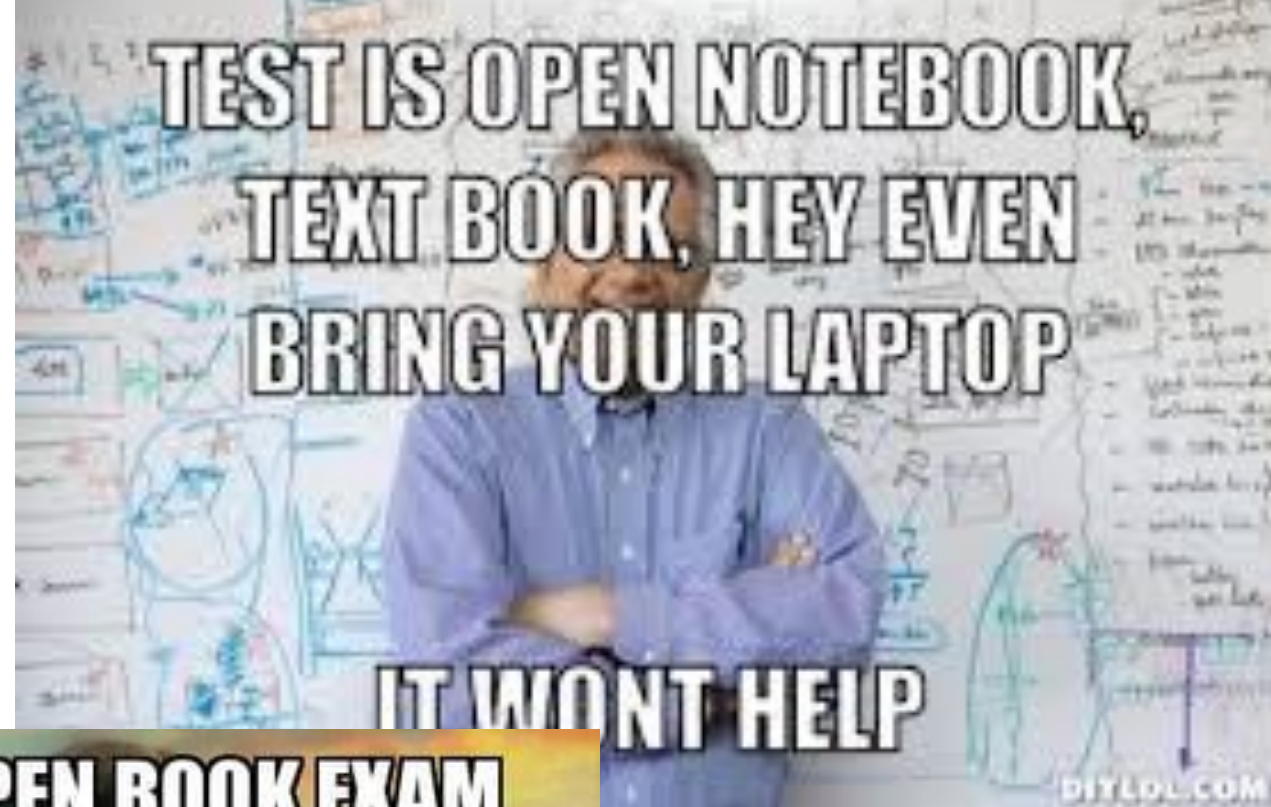
This is an **OPEN BOOK** examination: books, notes and other written or printed material **MAY BE CONSULTED** during the examination. The use of electronic devices or electronic media is **NOT PERMITTED**.



(chuckles)

I'm in danger

Exam is open-book, open-notes, calculators permitted*
: r/EngineeringStudents

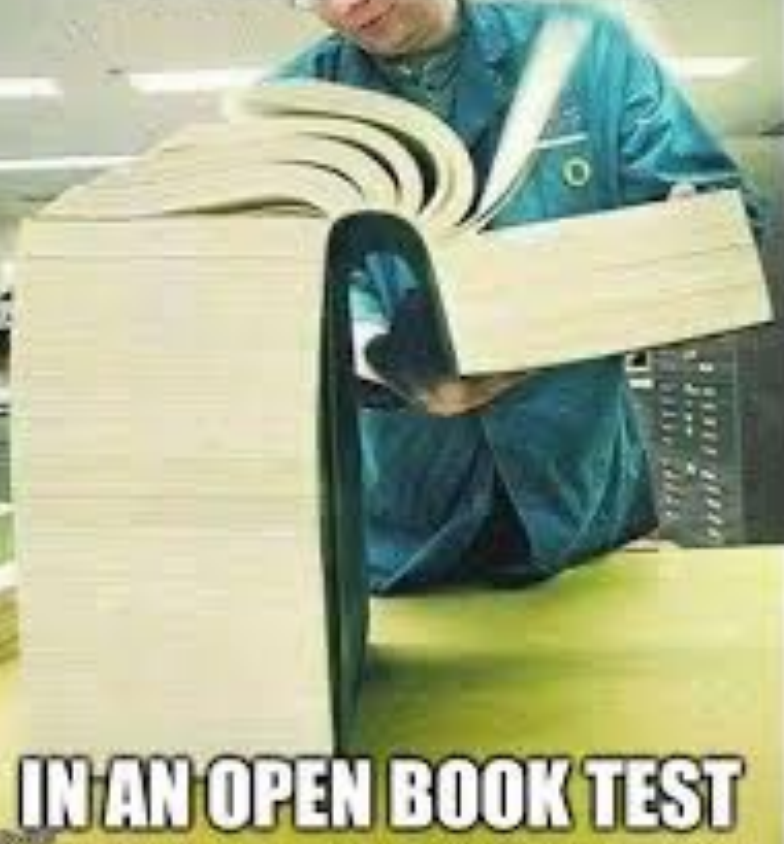


TEST IS OPEN NOTEBOOK,
TEXT BOOK, HEY EVEN
BRING YOUR LAPTOP

IT WON'T HELP

I THOUGHT AN OPEN BOOK EXAM
WOULD BE EASY

WHEN YOU ARE TRYING
TO FIND ANSWERS



IN AN OPEN BOOK TEST



I'VE NEVER BEEN SO WRONG

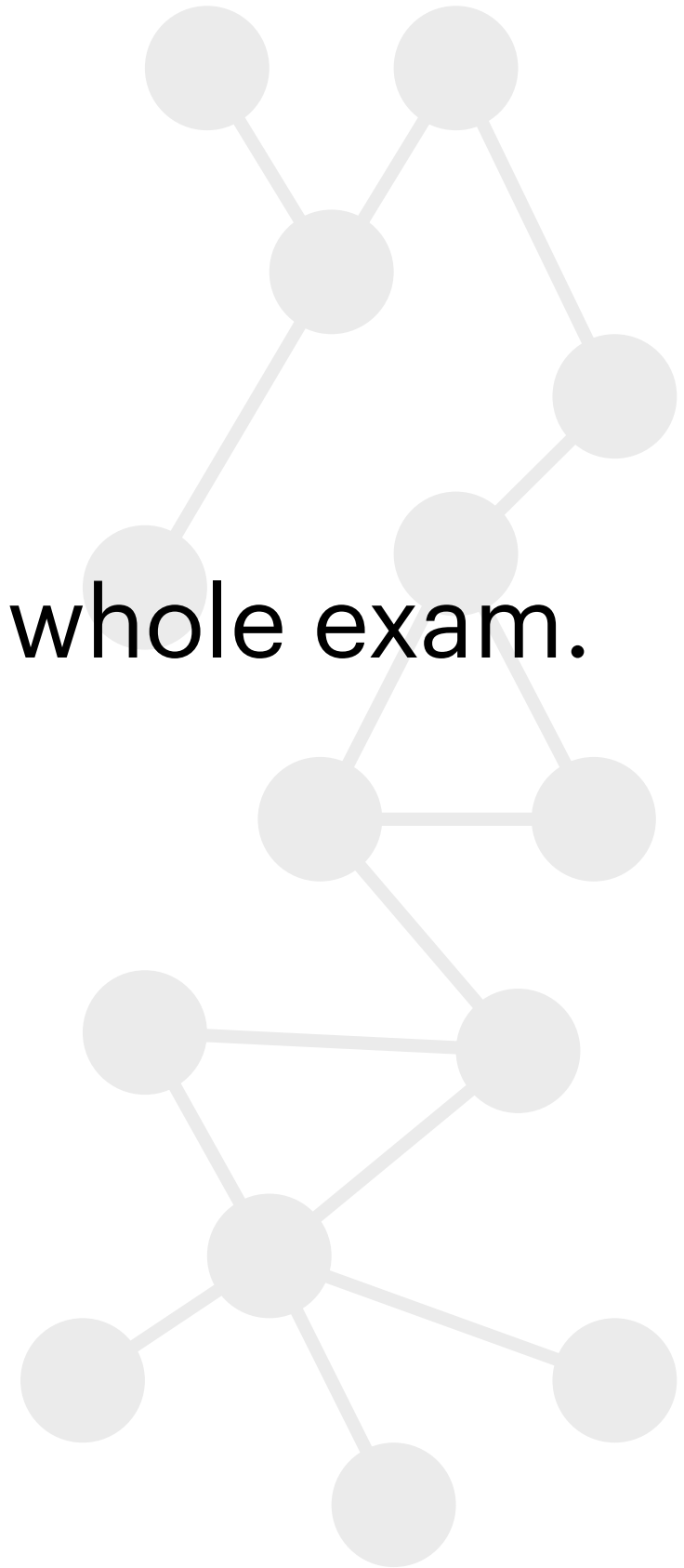
AN OPEN BOOK EXAM



IT'S A TRAP!

TIPS

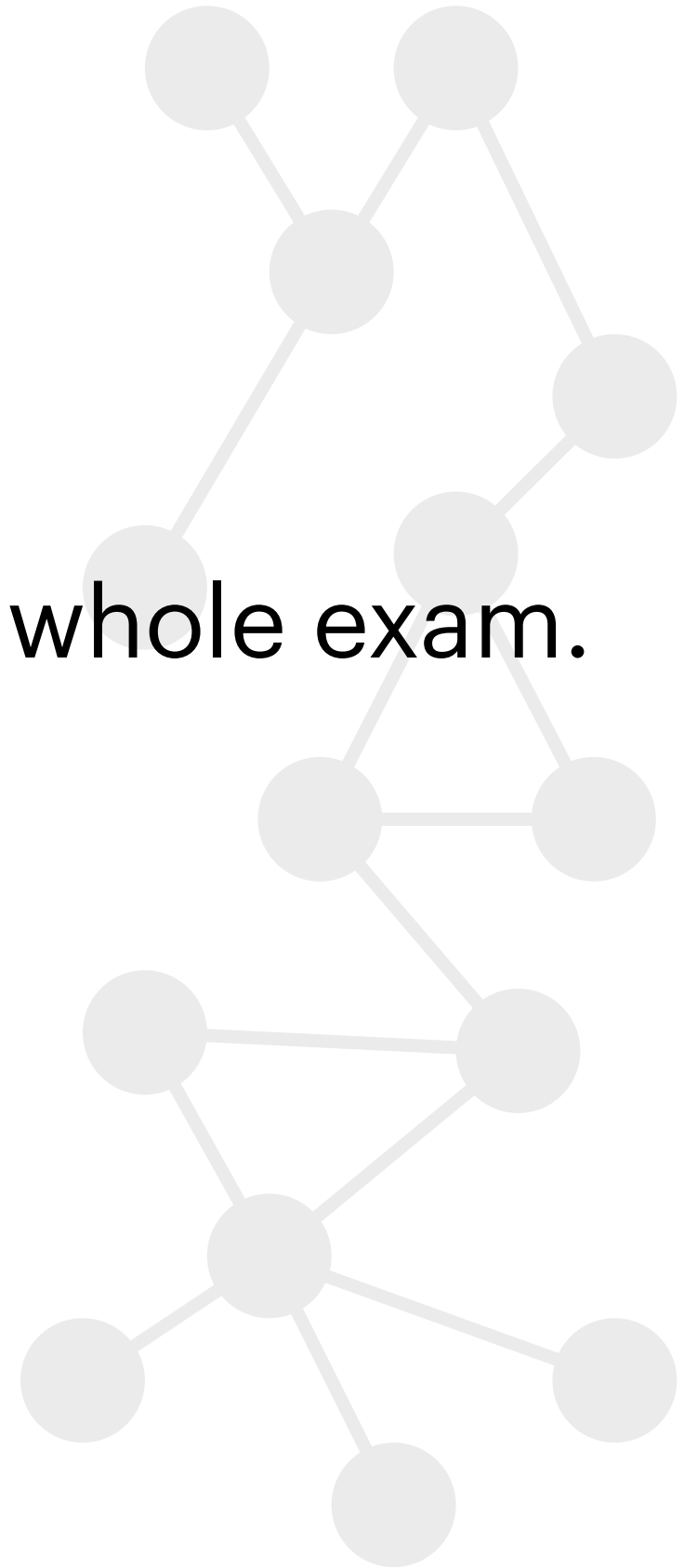
Yesterday's example was 50% of the whole exam.



TIPS

Yesterday's example was 50% of the whole exam.

Do answer questions in this session!

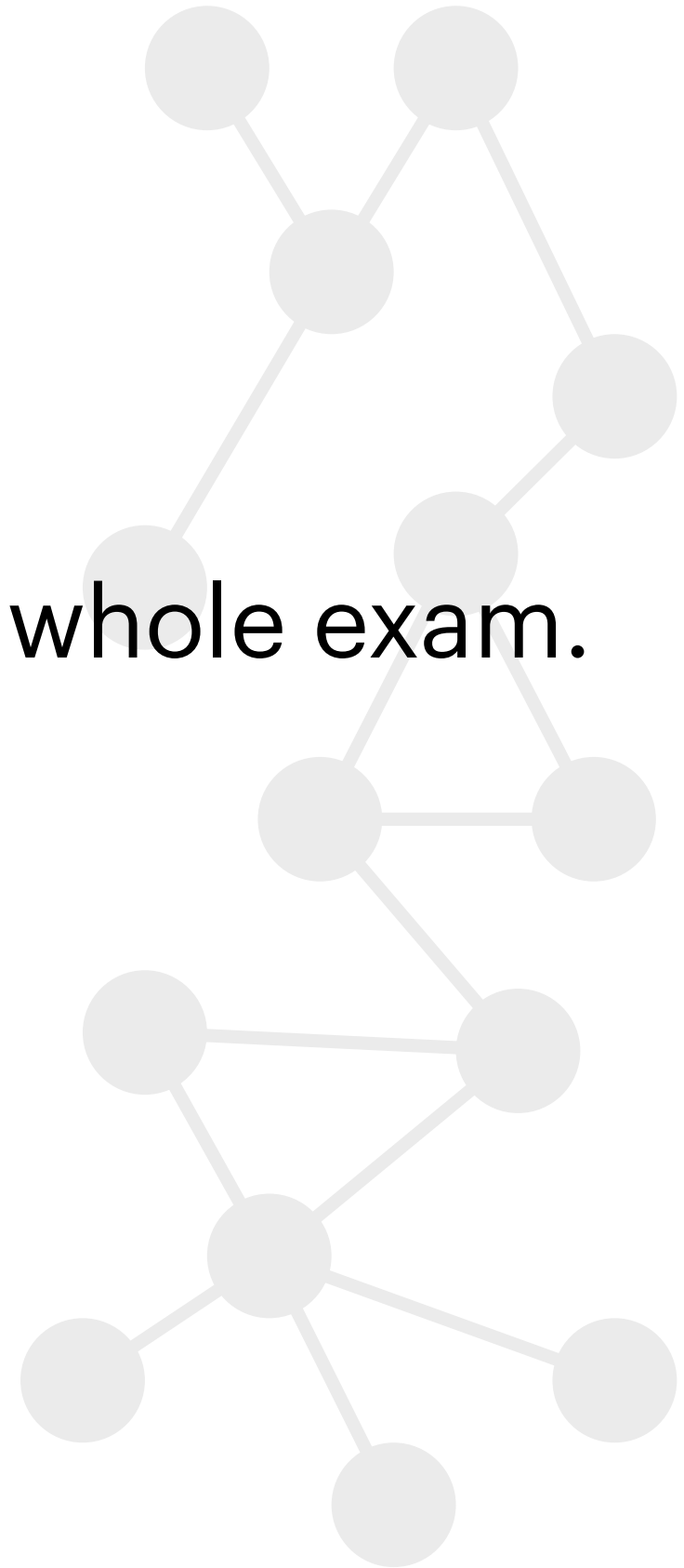


TIPS

Yesterday's example was 50% of the whole exam.

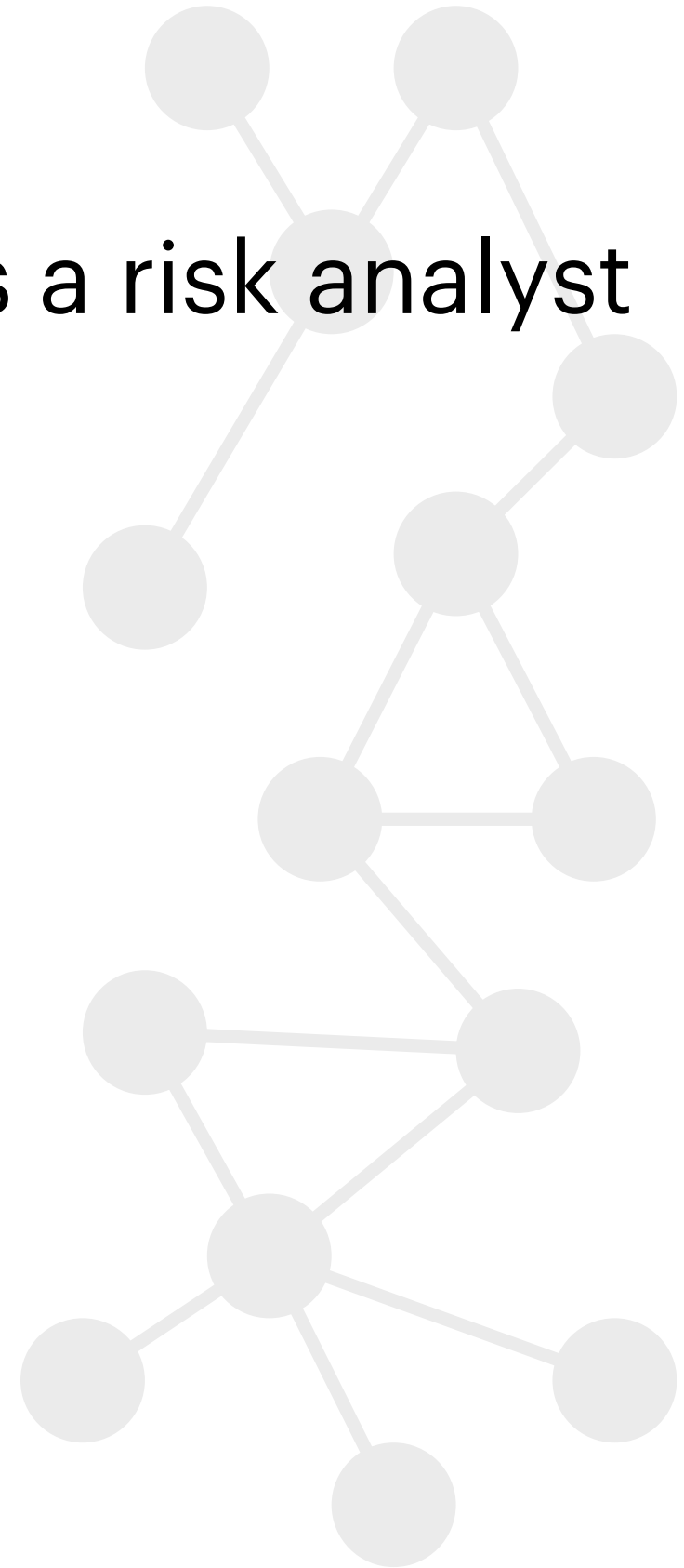
Do answer questions in this session!

Read the text well.



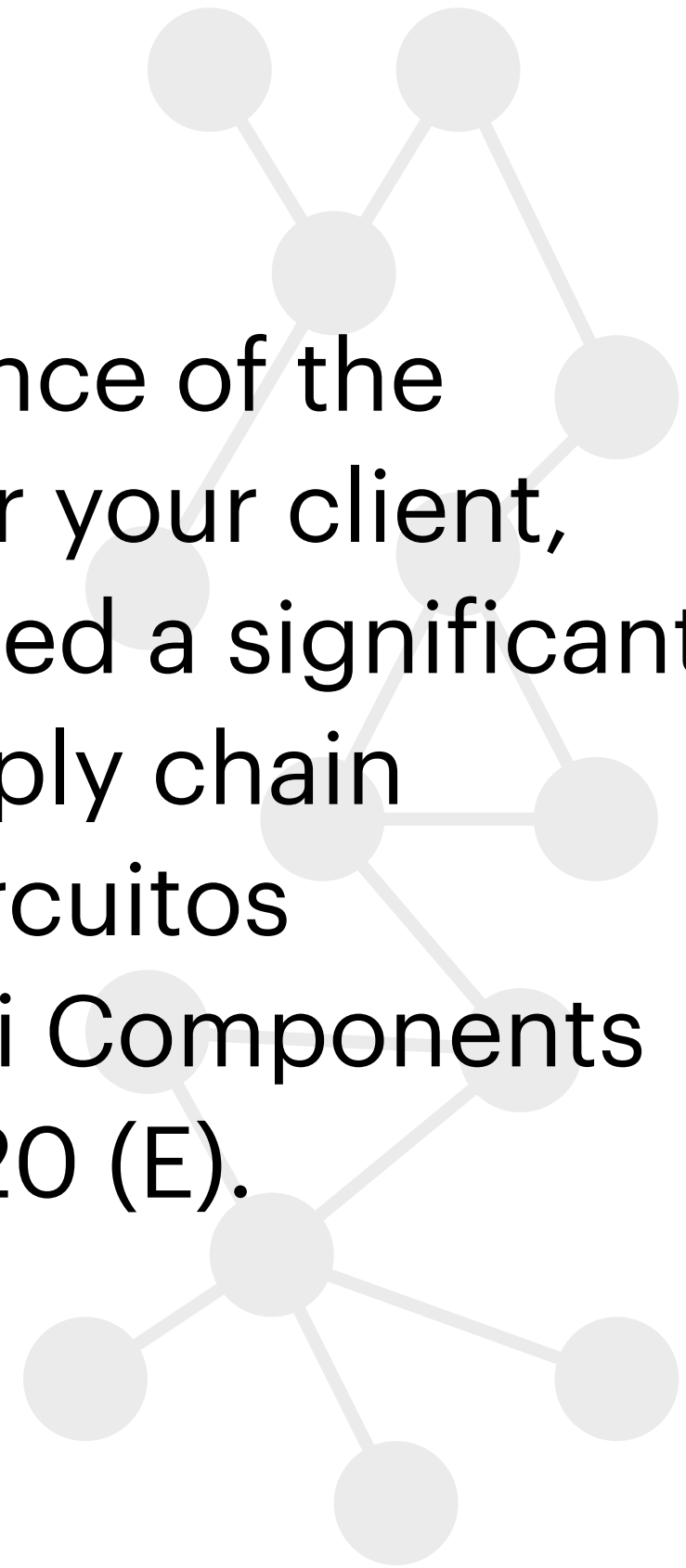
CONTEXT

Congratulations! You've been hired as a risk analyst by DBBA Consulting.



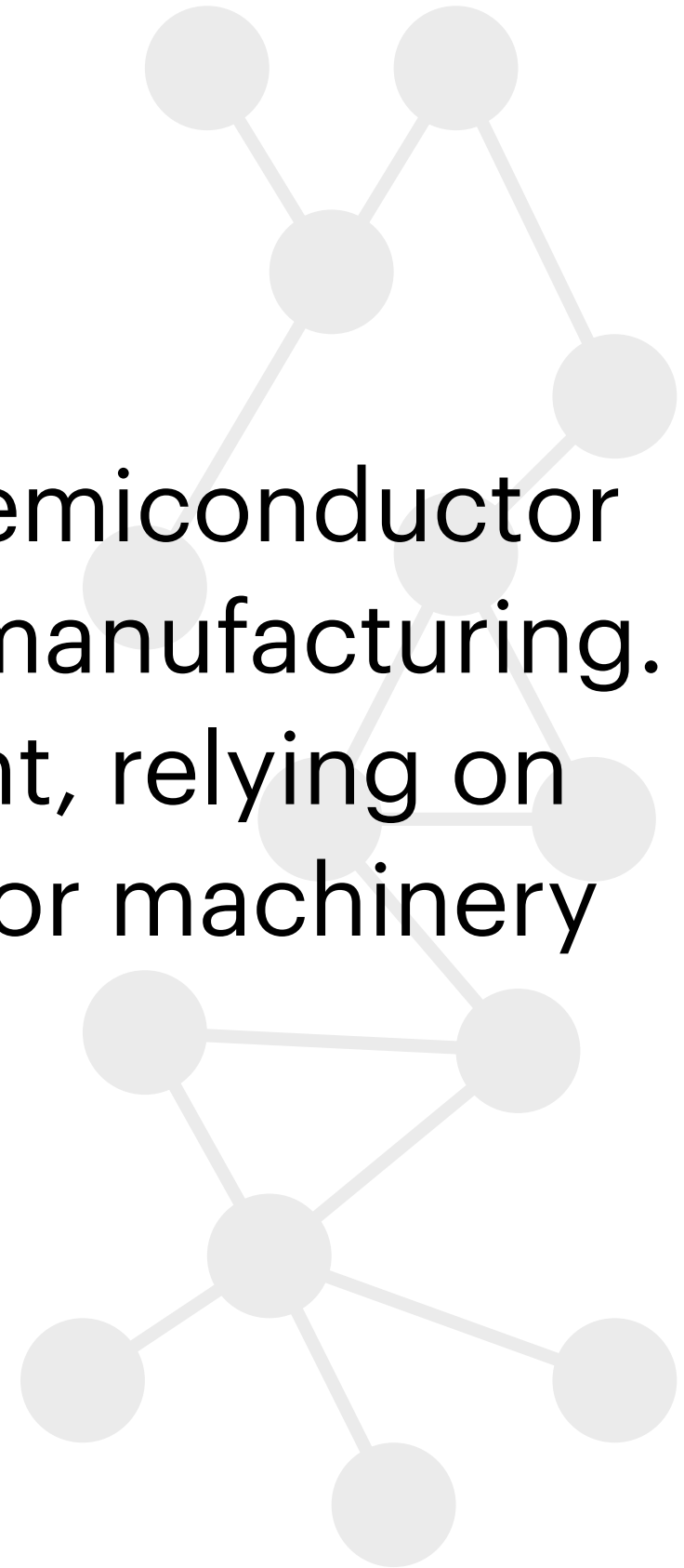
CONTEXT

Your first task is to evaluate the resilience of the global semiconductor supply chain for your client, Los Circuitos Hermanos (A), which faced a significant chip short-age crisis in 2023. This supply chain comprises five key companies: Los Circuitos Hermanos (A), Bluth Inc. (B), Cobra Kai Components (C), Dunder Circuits (D), Electronics 720 (E).



CONTEXT

These suppliers produce and supply semiconductor components essential for electronics manufacturing. Each company is highly interdependent, relying on the others for components, materials, or machinery necessary for chip production.



The following adjacency matrix represents the interdependencies among these companies, with values indicating the volume of semiconductor components shipped per quarter (in thousands):

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
<i>C</i>	10	10	0	0	40
<i>D</i>	0	0	30	0	0
<i>E</i>	0	0	0	60	0

Each supplier also maintains a backup inventory that lasts two quarters in case of disruptions.

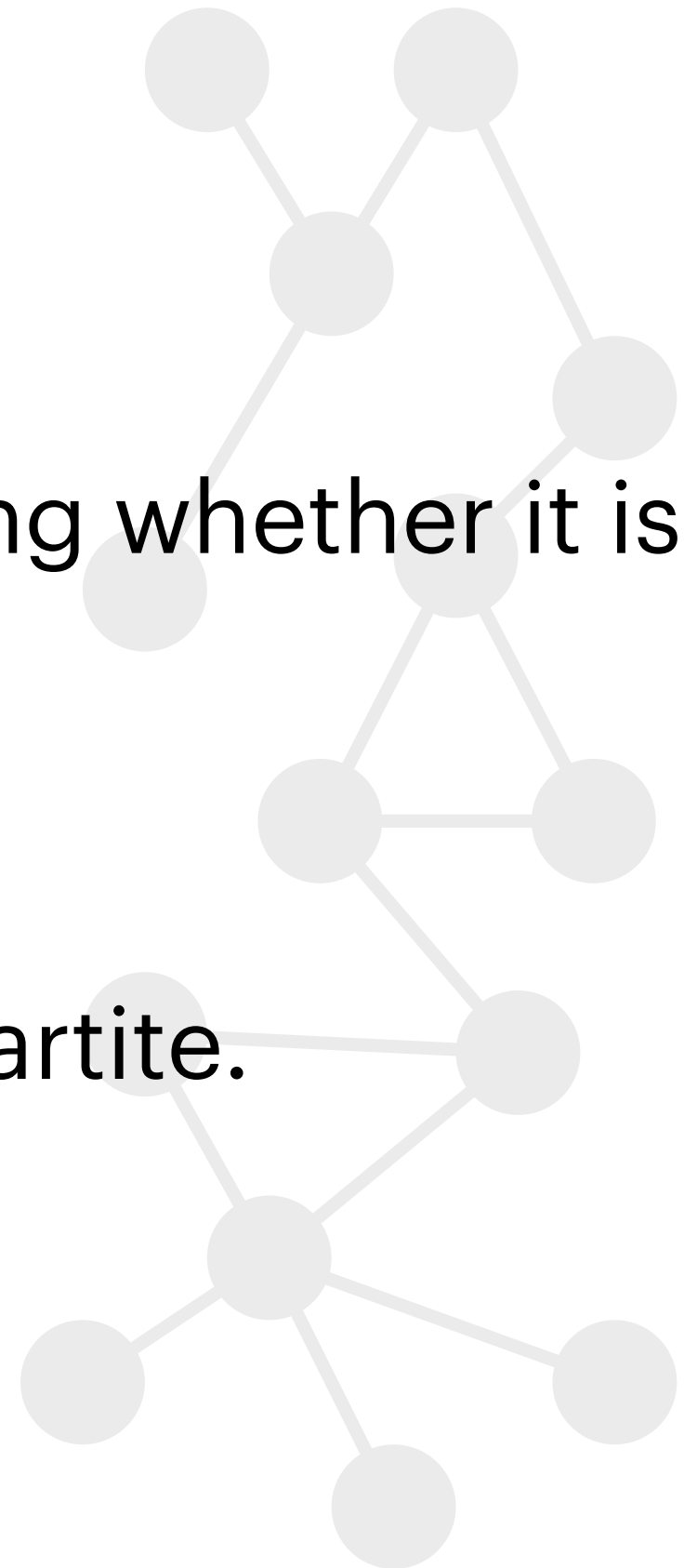
QUESTION 1

Use the adjacency matrix given above to answer the following questions:

QUESTION 1

- a) Describe the network, by specifying whether it is
- i) weighted or unweighted,
 - ii) directed or undirected,
 - iii) single-layer, multi-layer, or multipartite.

Justify your answers. [3 marks]



QUESTION 1

weighted or unweighted?

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
<i>C</i>	10	10	0	0	40
<i>D</i>	0	0	30	0	0
<i>E</i>	0	0	0	60	0

QUESTION 1

directed or undirected?

	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
<i>C</i>	10	10	0	0	40
<i>D</i>	0	0	30	0	0
<i>E</i>	0	0	0	60	0

QUESTION 1

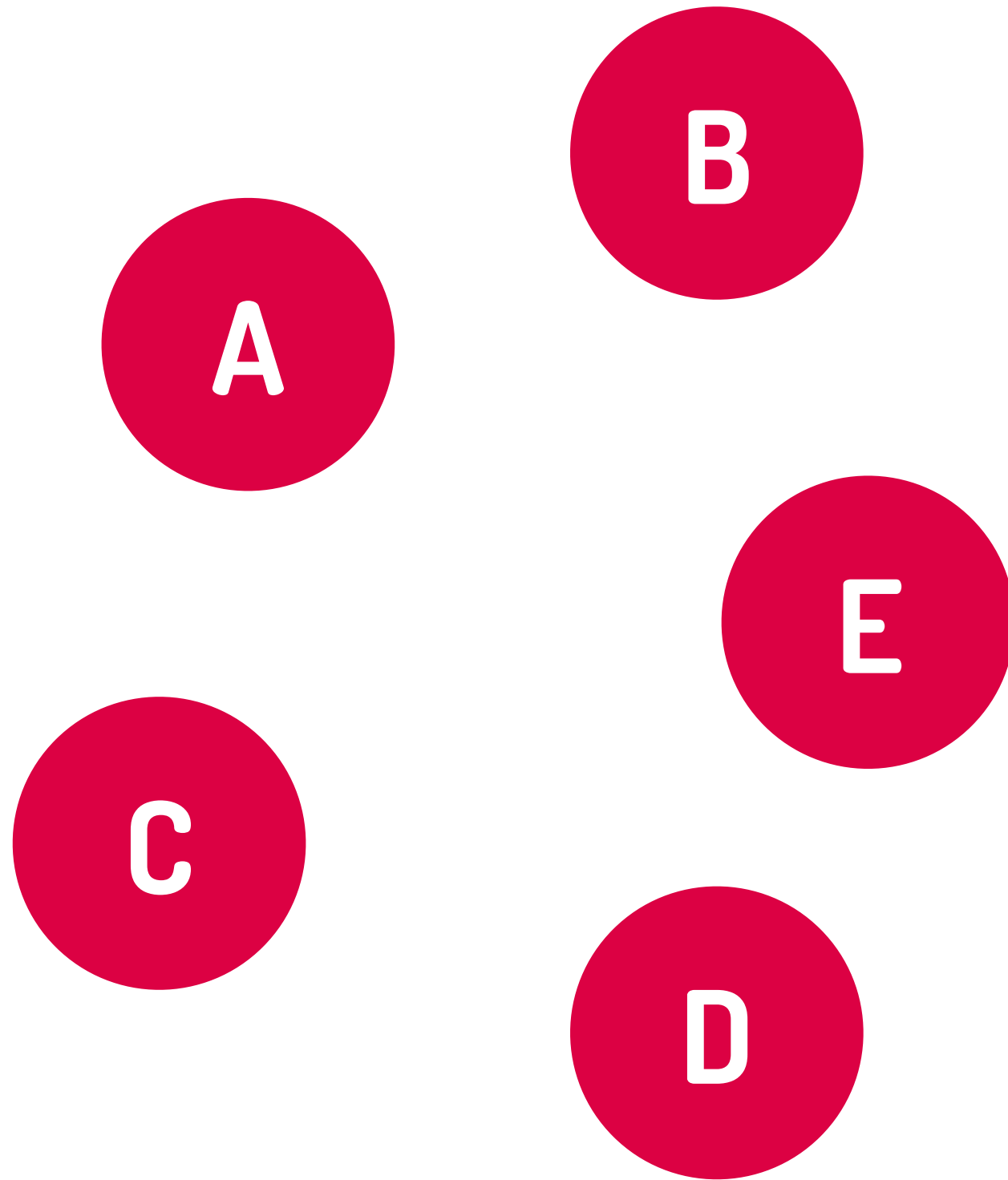
single-layer, multi-layer, or multipartite?

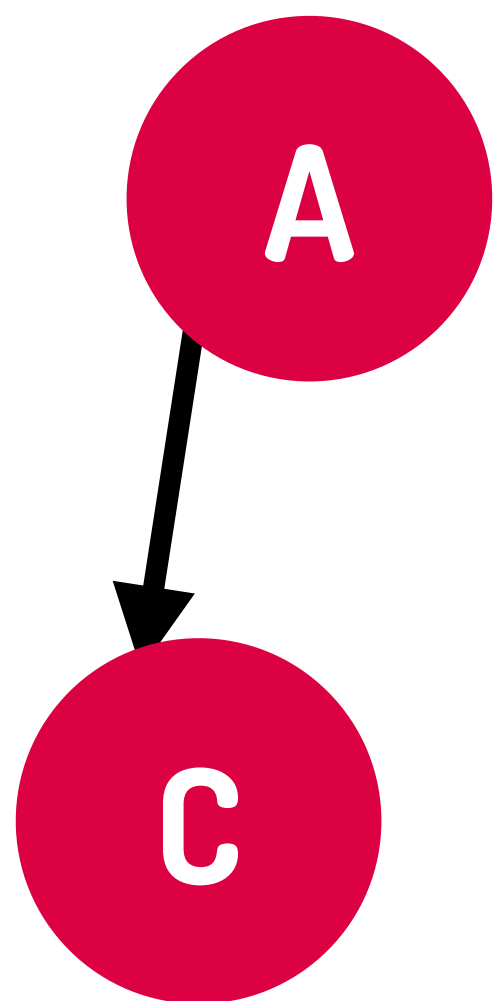
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
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<i>D</i>	0	0	30	0	0
<i>E</i>	0	0	0	60	0

QUESTION 1

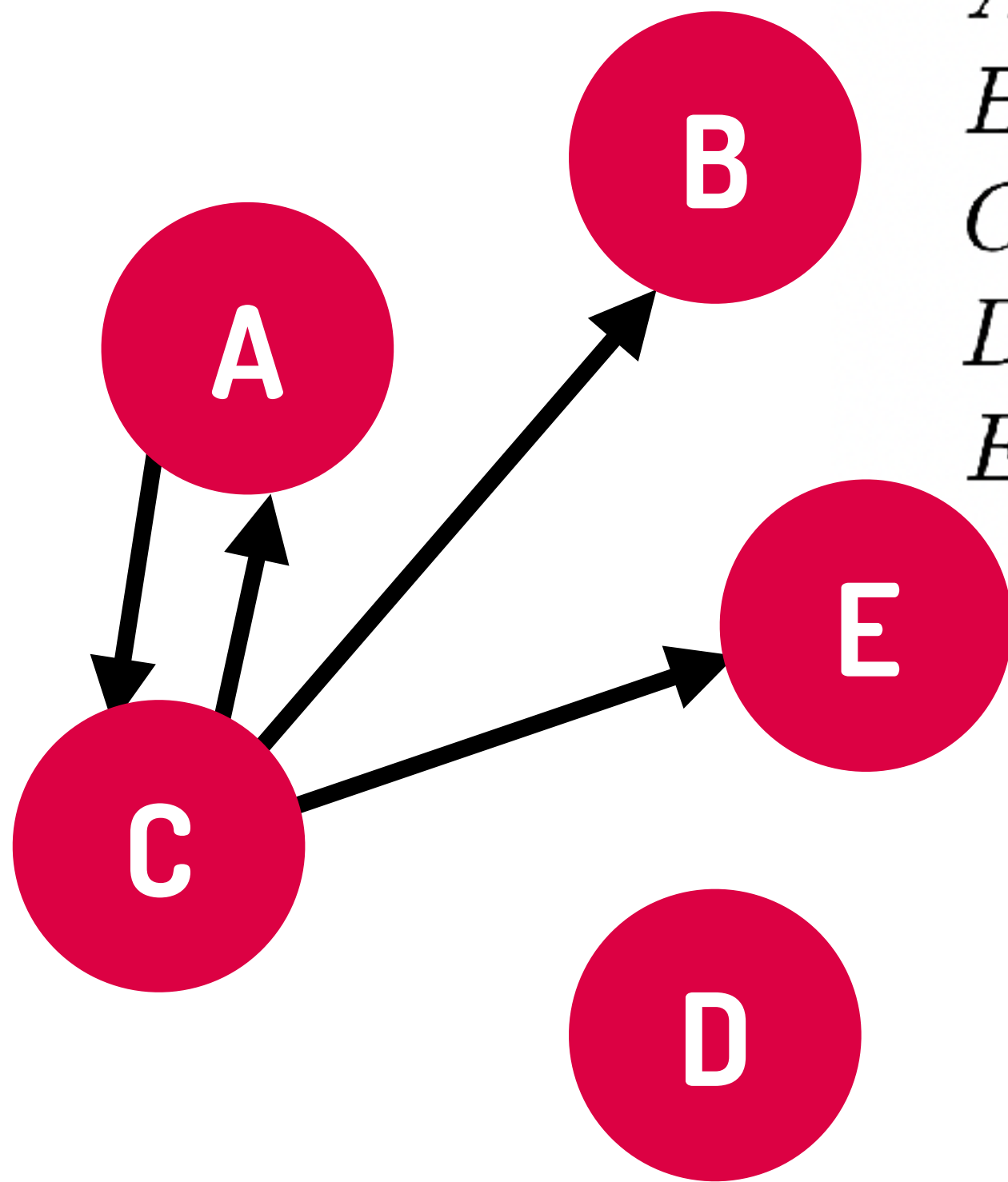
(b) Draw the network. [3 marks]

QUESTION 1

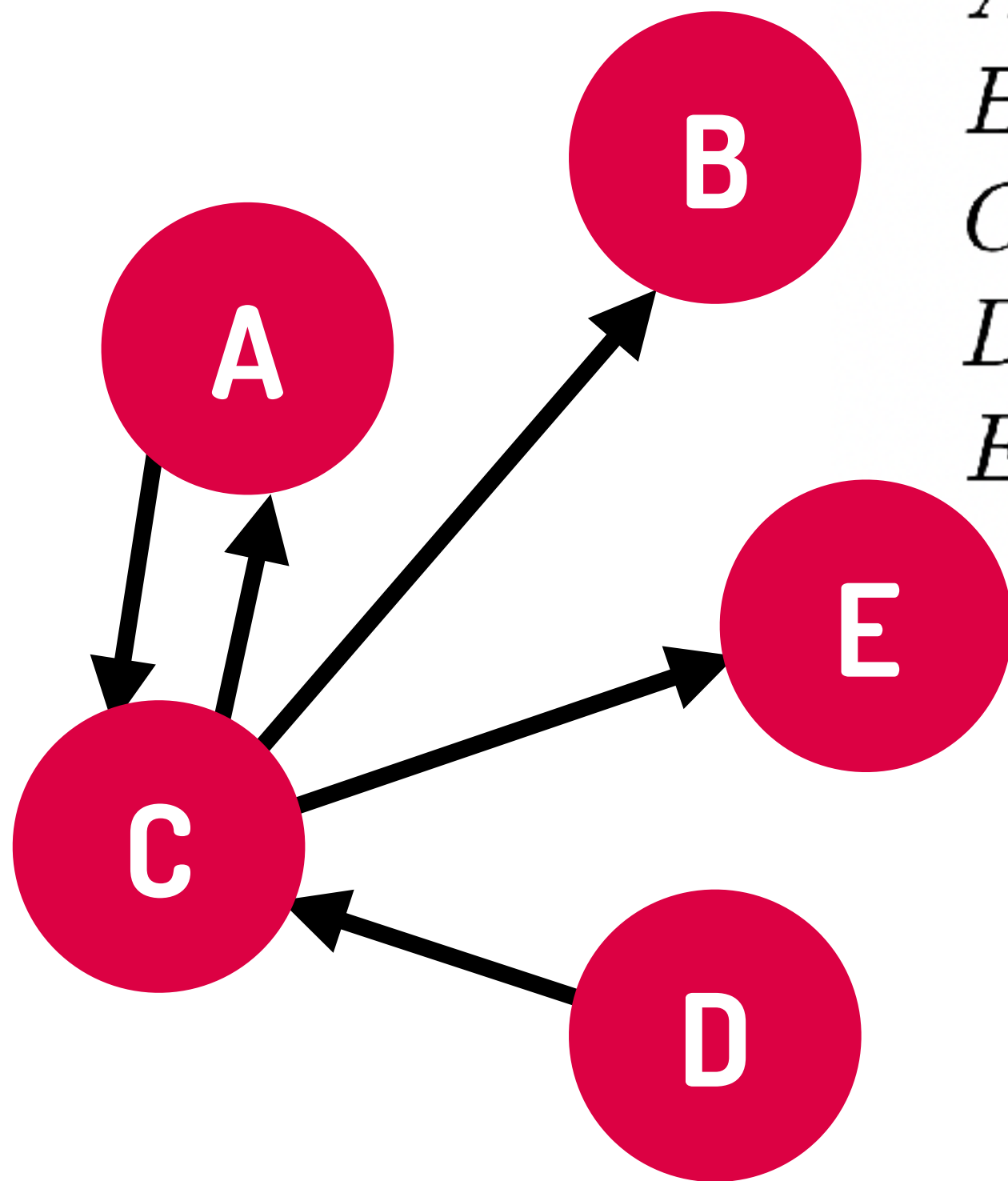




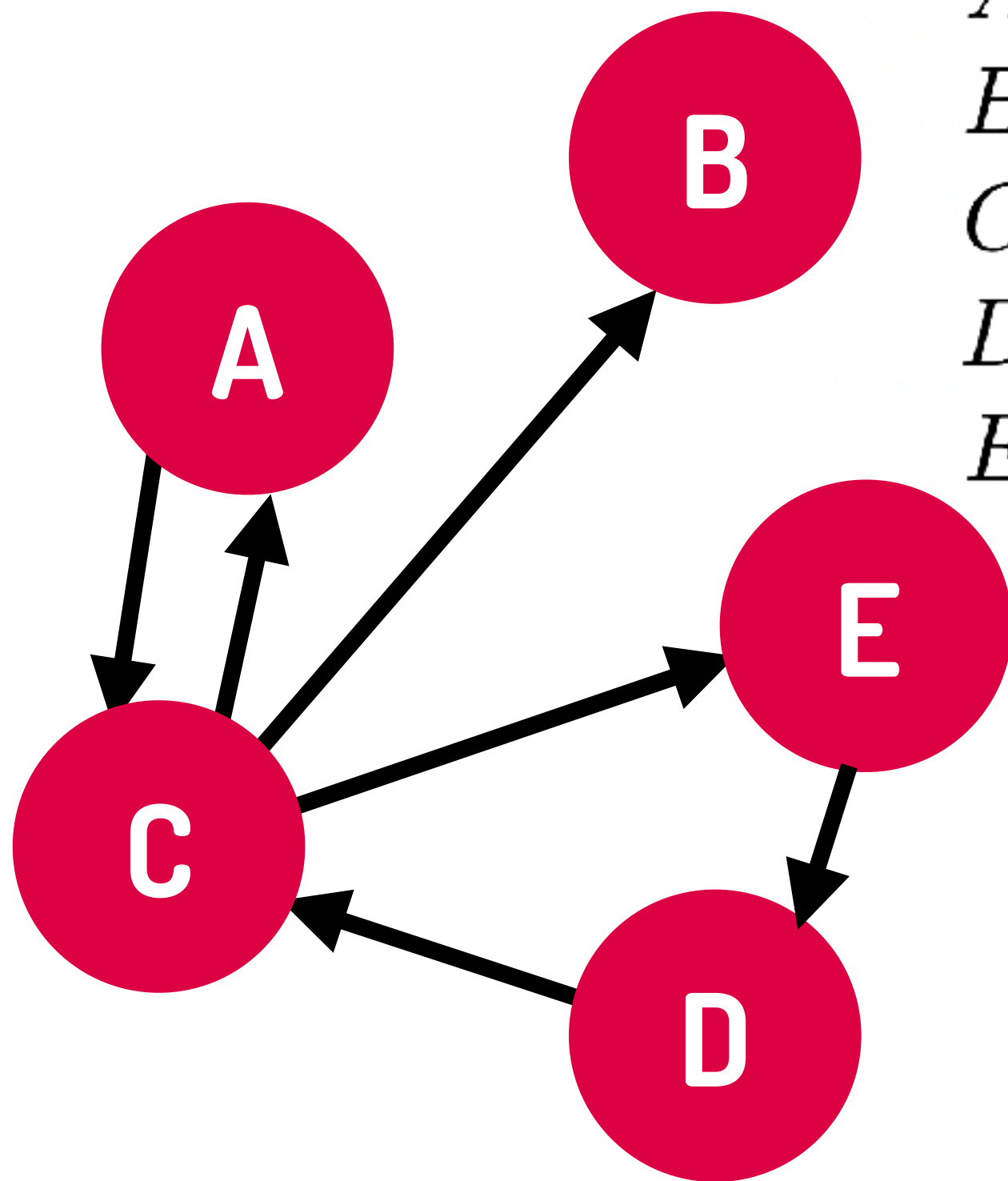
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
<i>C</i>	10	10	0	0	40
<i>D</i>	0	0	30	0	0
<i>E</i>	0	0	0	60	0



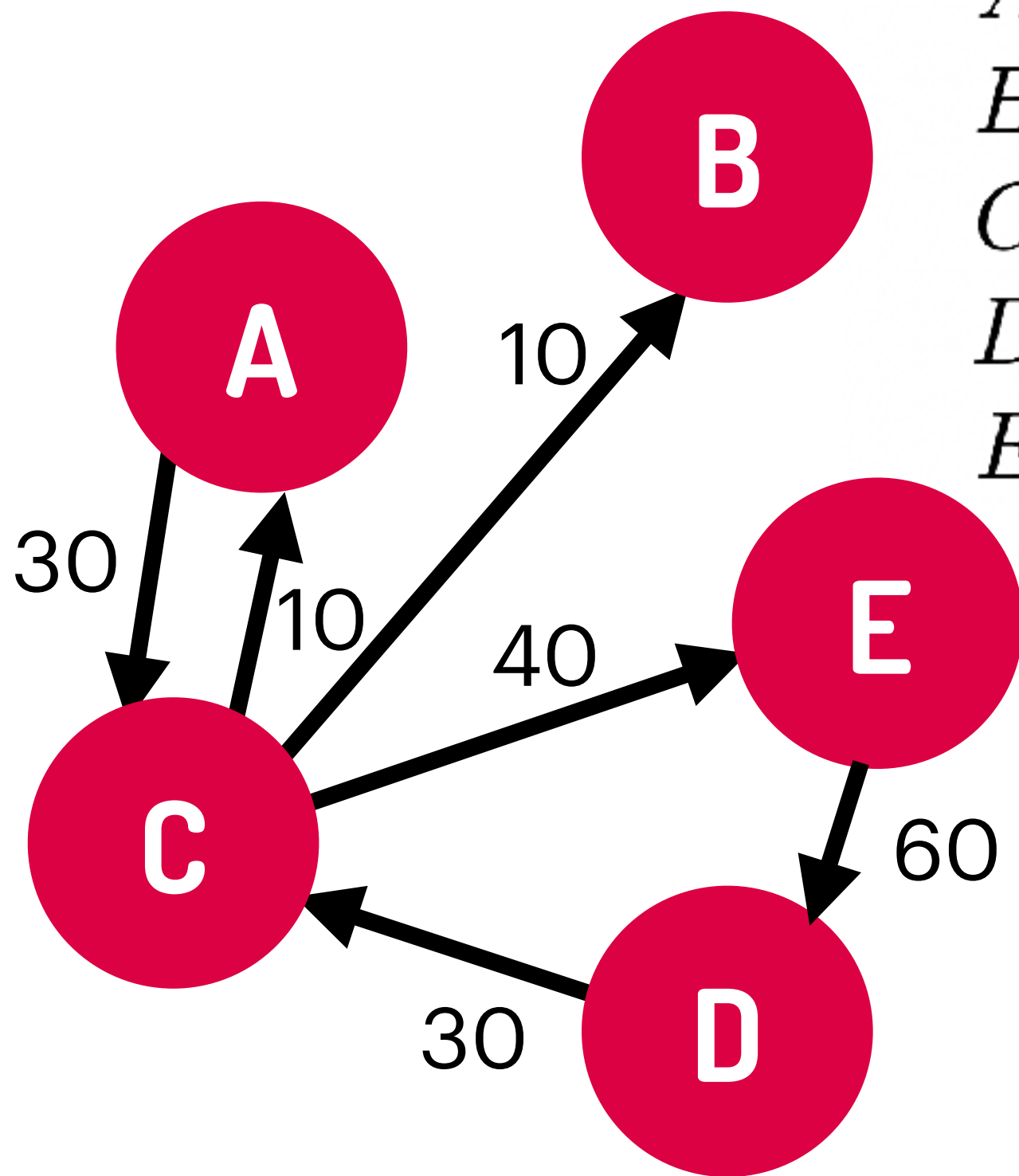
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
<i>C</i>	10	10	0	0	40
<i>D</i>	0	0	30	0	0
<i>E</i>	0	0	0	60	0



	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
<i>C</i>	10	10	0	0	40
<i>D</i>	0	0	30	0	0
<i>E</i>	0	0	0	60	0



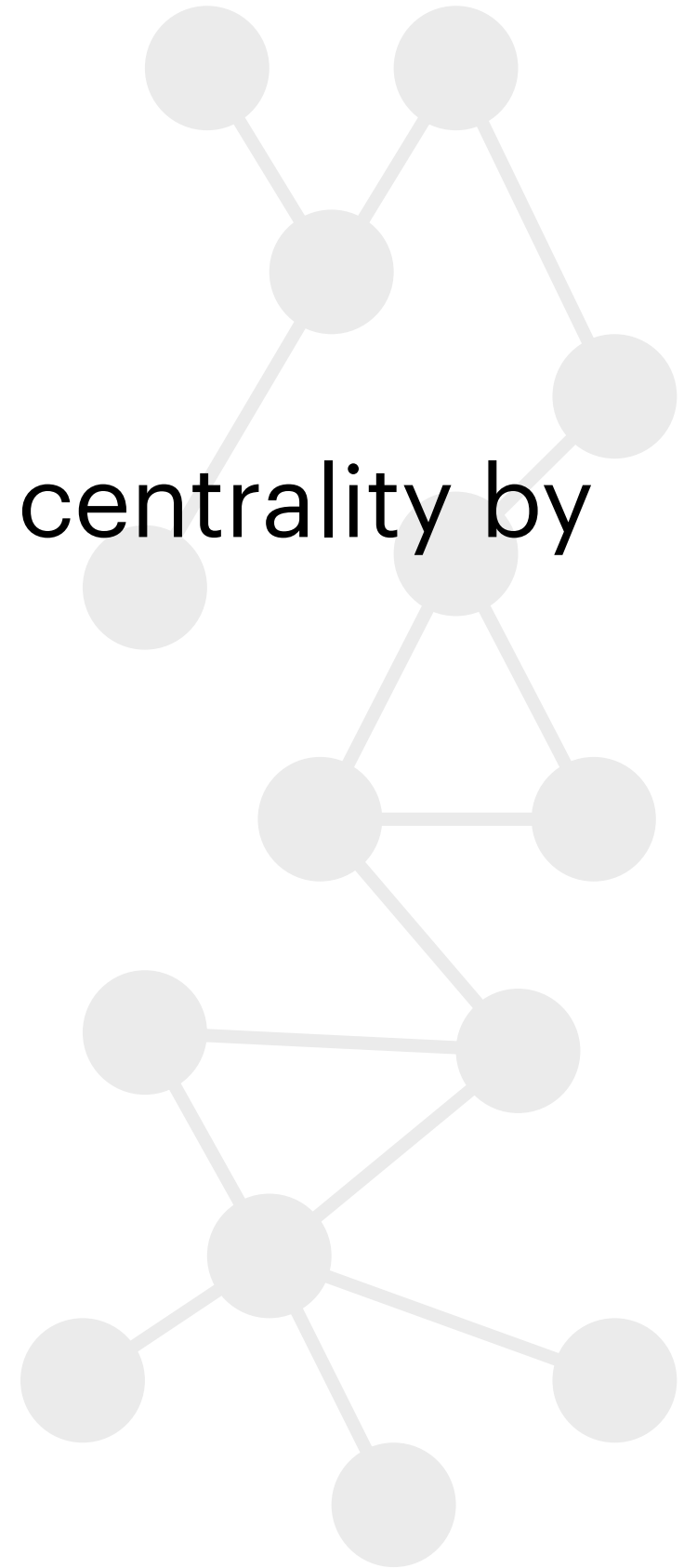
	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
<i>C</i>	10	10	0	0	40
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<i>E</i>	0	0	0	60	0



	<i>A</i>	<i>B</i>	<i>C</i>	<i>D</i>	<i>E</i>
<i>A</i>	0	0	30	0	0
<i>B</i>	0	0	0	0	0
<i>C</i>	10	10	0	0	40
<i>D</i>	0	0	30	0	0
<i>E</i>	0	0	0	60	0

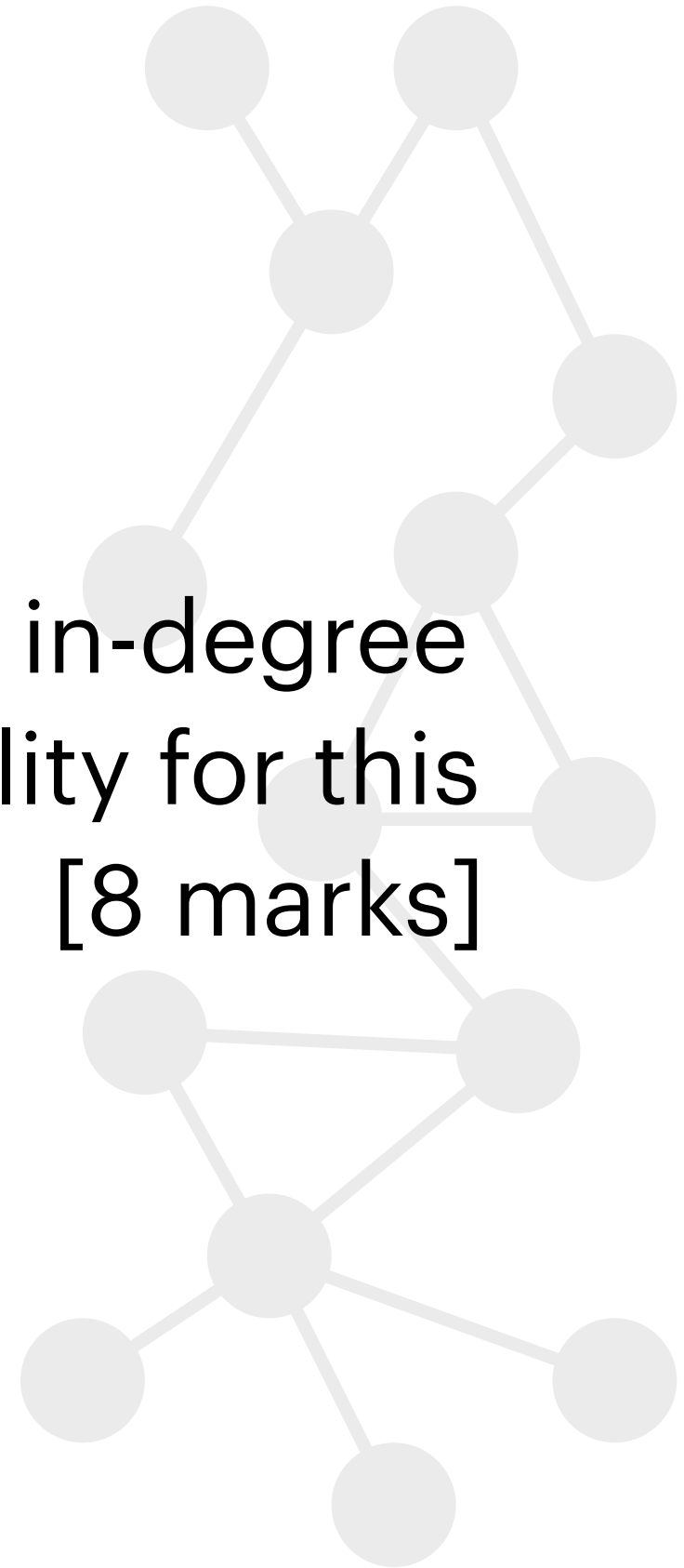
QUESTION 2

Analyse the role of suppliers through centrality by answering the following questions:



QUESTION 2

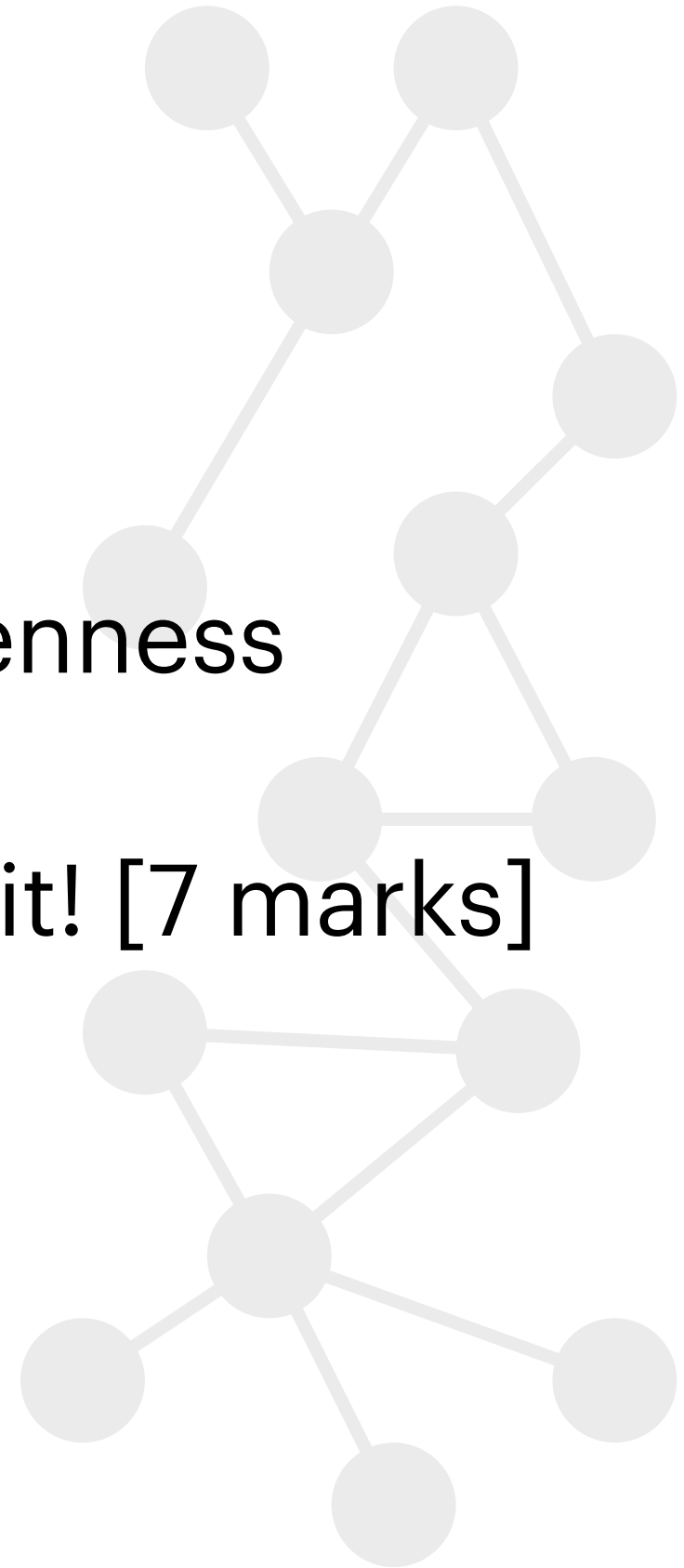
(a) Explain in detail the meaning of in-degree centrality and betweenness centrality for this specific network.
[8 marks]



QUESTION 2

(b) Explain how to calculate betweenness centrality for this specific network.

Note: you do not need to compute it! [7 marks]



QUESTION 2

Bonus question: which node is the one with the highest betweenness centrality?



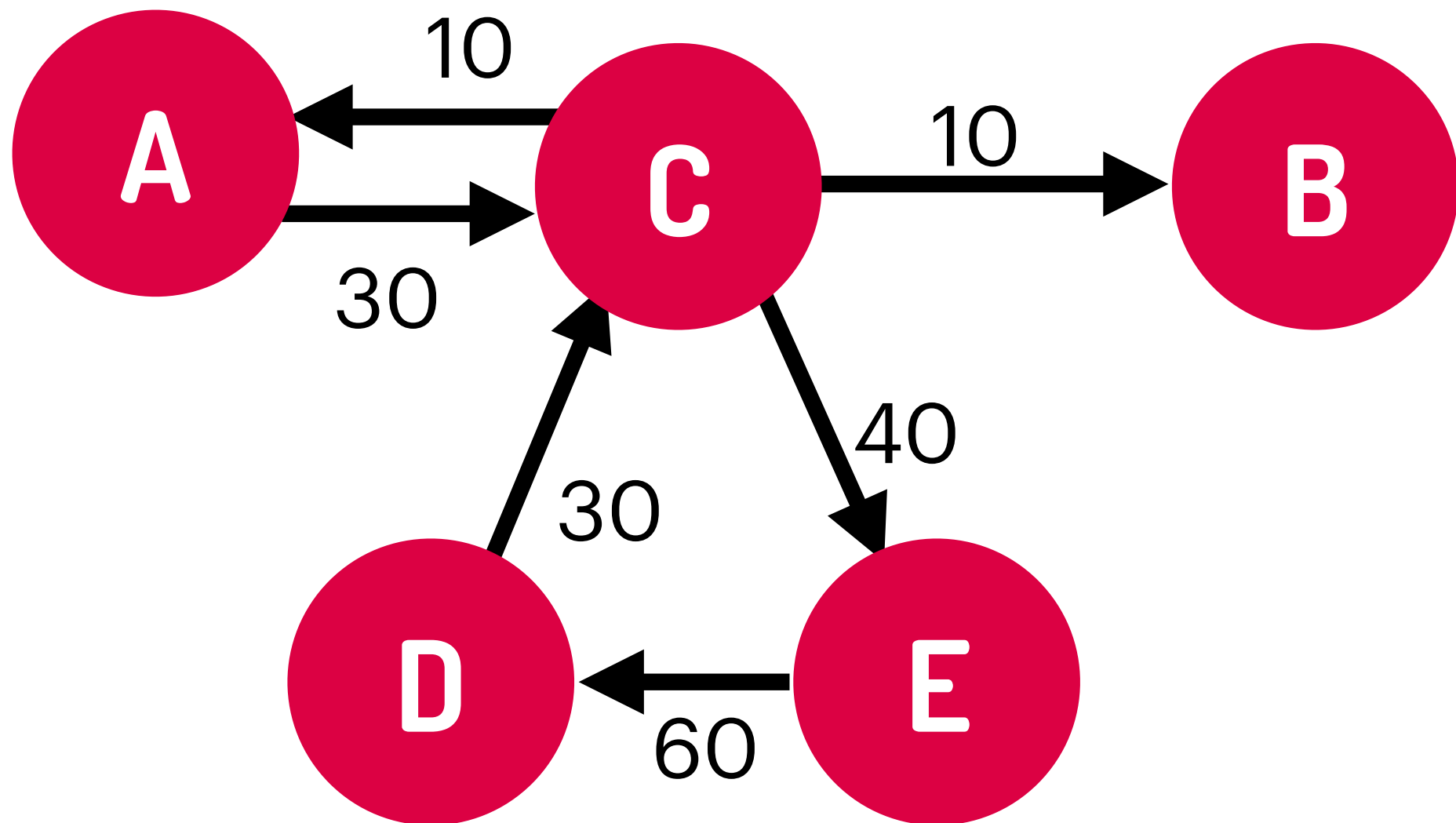
QUESTION 3

Supplier C's directors decided to use a novel AI model to manage the production of their components. The AI is quickly hacked and, as a result, C's production stops entirely for two quarters.



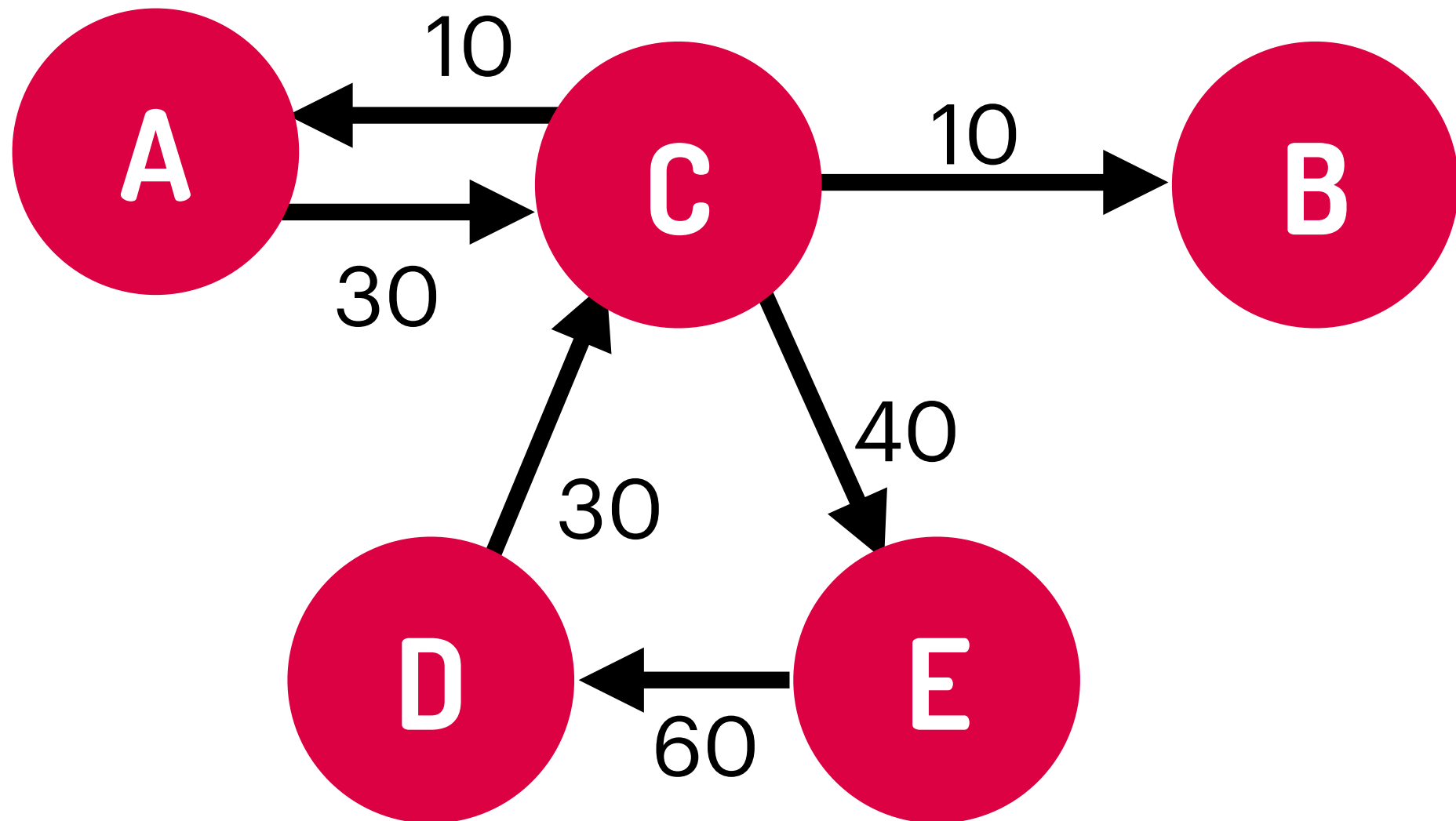
QUESTION 3

(a) Describe the cascading impact this might have on the other suppliers in the network and the potential for further disruptions. [7 marks]



QUESTION 3

(b) Discuss the network vulnerability to random failures and targeted attacks. [6 marks]



QUESTION 3

(c) What can suppliers do to make the network more robust? [5 marks]

