Tisha MAZUMDAR

Échelle d'évaluation standard : **A (% de réussite supérieur à 75%)**	Échelle d'évaluation pondérée : **A (% de réussite supérieur à 75%)**

EN - 2024-2025 - Algo av. - Graphes - 10 questions -1

Échelle d'évaluation standard : **A (% de réussite supérieur à 75%)**

? Question 1 **Question à réponse unique**

A connected graph is a graph in which:

Réponses incorrectes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☑	Oui (+1)	All vertices are connected to another vertex
B	☑	☐	Oui (+1)	There is at least one path between each pair of vertices
C	☐	☐	Non	All arcs point in the same direction.
D	☐	☐	Non	Each vertex is connected to itself by a loop.
E	☐	☐	Non	All vertices have the same degree.

? Question 2 **Question à réponse unique**

A Hamiltonian cycle in a graph is a cycle that:

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	Passes through each vertex of the graph exactly once.
B	☐	☐	Non	Passes through each arc of the graph exactly once.
C	☐	☐	Non	Passes at least twice through a vertex.
D	☐	☐	Non	Contains at least one vertex of degree 1.
E	☐	☐	Non	None of these proposals

? Question 3 **Question à réponse unique**

An adjacency list is a data structure that :

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	Represents the graph as a matrix.
B	☑	☑	Non	For each vertex, represents the vertices to which it is directly connected.
C	☐	☐	Non	Indicates distances between vertices.
D	☐	☐	Non	Used to calculate the number of cycles in a graph.
E	☐	☐	Non	Can only represent oriented graphs.

Question 4 — **Question à réponses multiples**

The directed graph G_{orr} has the vertices $V = \{A, B, C, D, E\}$, and the set of arcs $E = \{A \to B, A \to C, B \to C, C \to D, D \to B, D \to E, E \to A\}$
In graph G, which vertex/vertices has / have) an incoming degree equal to 2?

Réponses correctes | 0 discordance

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	A
B	☑ INDISPENSABLE	☑	Non	B
C	☑ INDISPENSABLE	☑	Non	C
D	☐	☐	Non	D
E	☐	☐	Non	E

Question 5 — **Question à réponse unique**

How many Hamiltonian cycles are there in graph G_{orr} ?

Réponses incorrectes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	0
B	☐	☐	Non	1
C	☐	☐	Non	4
D	☑	☐	Oui (+1)	5
E	☐	☑	Oui (+1)	6

Question 6 — Question à réponse unique

What is the adjacency matrix of graph G_{orr} ?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	

	A	B	C	D	E
A	0	1	1	0	0
B	0	0	1	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	1	0	0	0	0

B	☐	☐	Non	

	A	B	C	D	E
A	0	1	1	0	0
B	1	0	1	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	1	0	0	0	0

C	☐	☐	Non	

	A	B	C	D	E
A	0	1	0	1	0
B	0	0	1	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	1	0	0	0	0

D	☐	☐	Non	

	A	B	C	D	E
A	0	1	1	0	1
B	0	0	1	0	0
C	0	0	0	1	0
D	0	1	0	0	1
E	1	0	0	0	0

E	☐	☐	Non	

	A	B	C	D	E
A	0	1	1	0	0
B	0	0	1	0	1
C	0	0	0	1	0
D	0	1	0	0	1
E	1	0	0	0	0

Question 7 — Question à réponse unique

How many vertices are wells in graph G_{orr} ?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	0
B	☐	☐	Non	1
C	☐	☐	Non	2
D	☐	☐	Non	3
E	☐	☐	Non	4

Question 8 — **Question à réponse unique**

How many Eulerian paths exist in graph G_{orr} ?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	0
B	☐	☐	Non	1
C	☐	☐	Non	2
D	☐	☐	Non	4
E	☐	☐	Non	6

Annulée - Question 9 — **Question à réponse unique**

How many Hamiltonian paths exist in graph G_{orr} ?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	0
B	☐	☐	Non	2
C	☐	☐	Non	3
D	☐	☐	Non	4
E	☑	☑	Non	6

Question 10 — **Question à réponse unique**

Eight young men want to work in a supermarket where three positions are available. The manager, anxious to avoid problems, wants to take into account the enmities between these young men:
- Adrien can't stand Damien;
- Benjamin no longer speaks to Adrien;
- Cyril refuses to work with Benjamin;
- Damien can't stand Greg;
- Eric doesn't want to be around Benjamin, Frank or Hector;
- Frank doesn't like Greg and Hector;
- Greg doesn't get along with Adrien;
- Hector refuses to work with Frank or Cyril.

Who can we hire at the same time as Cedric, who has the best CV?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	Cyril and Greg
B	☐	☐	Non	Benjamin and Adrien
C	☐	☐	Non	Greg and Frank
D	☐	☐	Non	Damien and Greg
E	☐	☐	Non	None of these proposals

EN - 2024-2025 - Algo av. - Compléxité - 5 questions -1

Échelle d'évaluation standard : **C (% de réussite compris entre 25 et 50%)**

Question 1 — **Question à réponse unique**

A problem is said to be NP-complete if it satisfies which condition?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	It can be solved in polynomial time using a deterministic algorithm.
B	☐	☐	Non	All problem instances can be solved optimally.
C	☑	☑	Non	It belongs to NP and any problem in NP can be reduced to this problem in polynomial time.
D	☐	☐	Non	It can be solved in exponential time by a non-deterministic algorithm.
E	☐	☐	Non	It can be solved using a heuristic method in linear time.

Question 2 — **Question à réponse unique**

In a dense graph, which representation generally optimizes the complexity of path algorithms?

Réponses incorrectes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☑	Oui (+1)	Adjacency list
B	☐	☐	Non	Impact list
C	☑	☐	Oui (+1)	Adjacency matrix
D	☐	☐	Non	Oriented graph
E	☐	☐	Non	Weighted list

Question 3 — **Question à réponses multiples**

How do you prove that a problem is NP-complete?

Réponses correctes | 0 discordance

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑ INDISPENSABLE	☑	Non	Show that it belongs to NP (a solution can be verified in polynomial time)
B	☑ INDISPENSABLE	☑	Non	Reduce a known NP-complete problem to this polynomial-time problem
C	☐	☐	Non	Finding a solution in polynomial time
D	☐	☐	Non	Using effective heuristics
E	☐	☐	Non	Show that the problem is in P

Question 4 — **Question à réponse unique**

When analyzing the complexity of algorithms, what does the notation O(n!) mean?

Réponses incorrectes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	Linear complexity
B	☐	☐	Non	Quadratic complexity
C	☐	☑	Oui (+1)	Exponential complexity
D	☑	☐	Oui (+1)	Factor complexity
E	☐	☐	Non	Logarithmic complexity

Question 5 — **Question à réponse unique**

What is "polynomial reduction"?

Réponses incorrectes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☐	Oui (+1)	Transforming one problem into another in polynomial time
B	☐	☑	Oui (+1)	Simplify an algorithm to run in polynomial time
C	☐	☐	Non	Finding an approximate solution in polynomial time
D	☐	☐	Non	Breaking down a problem into sub-problems
E	☐	☐	Non	Use heuristics to reduce problem size

EN - Init- 2023-2024 - Algo. av. - Complexité - 9 questions

Échelle d'évaluation standard : **A (% de réussite supérieur à 75%)**

? Question 1 **Question à réponse unique**

A group of A3 students chat during a return trip. Their exceptional tutor, a certain Romain Brunelot, notes down some of their assertions as they go along:
- 3-SAT is NP-complete," says Emma.
- And I can add that a problem is NP-complete if and only if the validity and value of a solution can be verified in non-polynomial time," continues Marius.
- Conversely, any known solution of an NP problem can be verified in polynomial time," adds Karim.
- In any case, any NP problem is at most as difficult as the 3-SAT problem," retorts Clara.
I- f we consider a problem X that is in NP, then X is in NP-Complete if and only if all other problems in NP can be transformed into X in polynomial time, concludes Camille.
At the end of the prosit, Romain looked them straight in the eye. All the students looked up, alarmed at the announcement he was about to make. Romain dodged a slight smile and broke the silence by slowly telling them in a solemn tone:
- My young people, one or other of you has given me an erroneous statement. It's about :

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	Marius
B	☐	☐	Non	Camille
C	☐	☐	Non	Clara
D	☐	☐	Non	Emma
E	☐	☐	Non	Karim

Annulée - ? Question 2 **Question à réponse unique**

If there exists a solution to the Traveller problem in a directed graph G,, then G,necessarily contains:

Réponses incorrectes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	An Eulerian chain
B	☐	☑	Oui (+1)	A Hamiltonian cycle
C	☐	☐	Non	An Eulerian path
D	☐	☐	Non	An Eulerian circuit
E	☑	☐	Oui (+1)	A Hamiltonian circuit

Question 3 — **Question à réponse unique**

We'll use the word **path** to refer to the answer to the previous question, so as not to give the answer.
Consider $k \geq 3$ an integer.
Given an instance of the Traveling Salesman, i.e. a directed graph G containing n vertices and a path, checking that it is indeed a path of G and that its cost is less than k is done with complexity in :

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	$O(n^2)$
B	☐	☐	Non	$O(1)$
C	☐	☐	Non	$O(n)$
D	☐	☐	Non	$O(n!)$
E	☐	☐	Non	$O(0)$

Question 4 — **Question à réponse unique**

What can we deduce from the previous question?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	Traveling Salesman reduces polynomially to the Hamiltonian Chain problem
B	☑	☑	Non	Traveling Salesman is in NP
C	☐	☐	Non	Traveling Salesman is in NP-hard
D	☐	☐	Non	Traveling Salesman is in NP-complete
E	☐	☐	Non	Traveling Salesman is outside NP and NP-hard

Question 5 — **Question à réponse unique**

We know that the Traveling Salesman problem is at least as difficult as any problem in NP.
This statement and the answer to the previous question allow us to conclude that the problem Traveling Salesman:

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	is in P
B	☐	☐	Non	is impossible to solve
C	☑	☑	Non	is in NP-complete
D	☐	☐	Non	is in NP-hard
E	☐	☐	Non	is outside NP and NP-hard

? Question 6 **Question à réponse unique**

What is the purpose of the travelling salesman problem?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	Find the shortest path between two points.
B	☐	☐	Non	Find the longest path between two points.
C	☑	☑	Non	Find the shortest route that visits each city once and returns to the starting point.
D	☐	☐	Non	Find the longest path that visits each city once and returns to the starting point.
E	☐	☐	Non	Find a path that visits each city once and returns to the starting point.

? Question 7 **Question à réponse unique**

What is the symmetrical TSP problem?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	The TSP where the distances between each pair of cities are different
B	☑	☑	Non	The TSP where the distances between each pair of cities are the same
C	☐	☐	Non	The TSP where each city must be visited a certain number of times

? Question 8 **Question à réponse unique**

Which of the following problems is not in the NP-complete class?

Réponses correctes

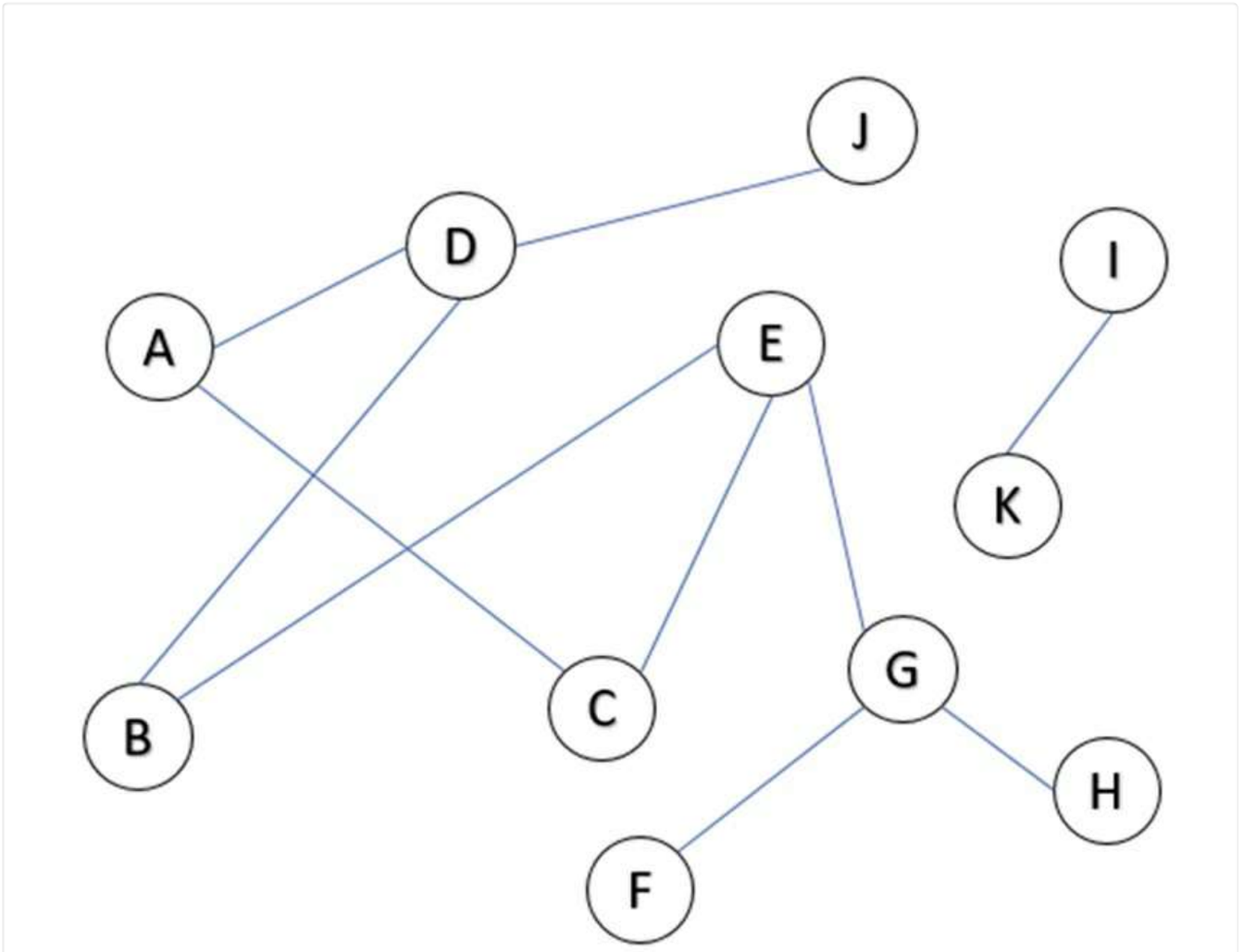
	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	Shortest route
B	☐	☐	Non	Hamiltonian cycle
C	☐	☐	Non	Classification
D	☐	☐	Non	Traveling salesman

EN - 2023-2024 - Algo av. - Graphes - 5 questions

Échelle d'évaluation standard : **A (% de réussite supérieur à 75%)**

Annulée - ? Question 1 **Question à réponse unique**

Is the following graph complete?



Réponses incorrectes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☐	Oui (+1)	Yes
B	☐	☑	Oui (+1)	No

? Question 2 **Question à réponse unique**

How many cycles are there in the graph above?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	2
B	☐	☐	Non	1
C	☑	☑	Non	0
D	☐	☐	Non	3
E	☐	☐	Non	5

Annulée - Question 3 — **Question à réponse unique**

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☑	Non	11
B	☐	☐	Non	10
C	☐	☐	Non	13
D	☐	☐	Non	9
E	☐	☐	Non	12

Annulée - Question 4 — **Question à réponse unique**

Réponses incorrectes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☑	☐	Oui (+1)	Yes
B	☐	☑	Oui (+1)	No

Question 5 — **Question à réponse unique**

Is there an Eulerian chain in the graph above?

Réponses correctes

	Réponse attendue	Réponse saisie	Réponse discordante	
A	☐	☐	Non	Yes
B	☑	☑	Non	No