ALGO MCQ

1. **A binary search tree is a labeled binary tree fitted with a _____ order relation ?**
   - (a) partial
   - (b) balanced
   - (c) local
   - (d) total ✓

2. **Whether you use the insertion at the root or at the leaf, the resulting binary search tree is the same ?**
   - (a) true
   - (b) false ✓

3. **In the worst case, for the search in a BST, the complexity order is ?**
   - (a) linear ✓
   - (b) logarithmic
   - (c) quadratic
   - (d) constant

4. **The leaves of a BST are located at worst on two levels ?**
   - (a) true
   - (b) false ✓

5. **The depth of a BST can be ?**
   - (a) a quadratic funtion of its size
   - (b) a logarithmic funtion of its size ✓
   - (c) a linear funtion of its size ✓
   - (d) a exponential funtion of its size

6. **The non-degenerate binary tree B whose preorder traversal is $(6, 8, 10, 12, 14, 18, 30, 32, 35, 37, 42, 45, 47)$ is a BST.**
   - (a) Faux ✓
   - (b) Vrai

7. **The non-degenerate binary tree B whose inorder traversal is $(6, 8, 10, 12, 14, 18, 30, 32, 35, 37, 42, 45, 47)$ is a BST.**
   - (a) Faux
   - (b) Vrai ✓

8. **The non-degenerate binary tree B whose postorder traversal is $(6, 8, 10, 12, 14, 18, 30, 32, 35, 37, 42, 45, 47)$ is a BST.**
   - (a) Faux ✓
   - (b) Vrai

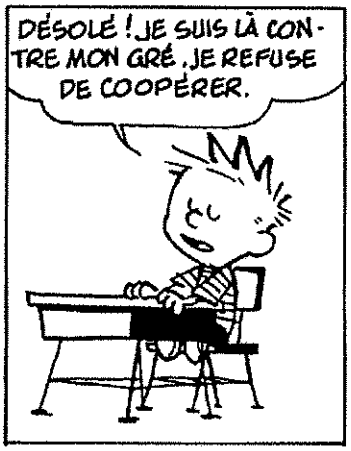
Consider the binary search tree B:

$$< 14, < 10, < 6, \emptyset, \emptyset >, < 11, \emptyset, \emptyset >>, < 35, < 30, < 16, \emptyset, \emptyset >, < 33, \emptyset, \emptyset >>, \emptyset >>$$

Where the numbers are the nodes and where $\emptyset = emptytree$

9. **The preorder traversal of the ABR $B2$, modified by inserting the value 15 at leaf, is ?**
   (a) $(6, 10, 11, 14, 15, 16, 30, 33, 35)$
   (b) $(14, 10, 6, 11, 35, 30, 16, 15, 33)$
   (c) $(15, 14, 10, 6, 11, 35, 30, 16, 33)$
   (d) $(6, 11, 10, 14, 16, 33, 30, 35, 15)$
   (e) $(6, 11, 10, 15, 16, 33, 30, 35, 14)$

10. **The postorder traversal of the ABR $B2$, modified by inserting the value 15 at root, is ?**
    (a) $(6, 10, 11, 14, 15, 16, 30, 33, 35)$
    (b) $(14, 10, 6, 11, 35, 30, 16, 15, 33)$
    (c) $(15, 14, 10, 6, 11, 35, 30, 16, 33)$
    (d) $(6, 11, 10, 14, 16, 33, 30, 35, 15)$
    (e) $(6, 11, 10, 15, 16, 33, 30, 35, 14)$



MCQ 6

Monday, 8 April

Question 11

Let E and F be two $\mathbb{R}$-vector spaces and $f : E \longrightarrow F$ a linear map. Let $(u, v) \in E^2$. Then:

a. $f(2.u) = u.f(2)$

b. $f(u + v) = u + v$

c. $f(u + v) = f(u) + f(v)$

d. $f(u) = -f(u)$

e. None of the others

Question 12

Let $f : \begin{array}{ccc} \mathbb{R} & \longrightarrow & \mathbb{R} \\ x & \longmapsto & x^3 \end{array}$. Then f is a linear map from $\mathbb{R}$ to $\mathbb{R}$.

a. True

b. False

Question 13

Consider a mapping $f : \mathbb{R}^3 \longrightarrow \mathbb{R}^2$ such that $f\big((0,0,0)\big) = (1,0)$. Then:

a. f can be a linear map from $\mathbb{R}^3$ to $\mathbb{R}^2$.

b. f cannot be a linear map from $\mathbb{R}^3$ to $\mathbb{R}^2$.

Question 14

Let f be a linear map from $\mathbb{R}^2$ to $\mathbb{R}$ such that $f\big((1,0)\big) = 2$ and $f\big((0,1)\big) = -3$. Then:

a. $f\big((1,-1)\big) = -1$

b. $f\big((1,-1)\big) = 5$

c. $f\big((0,0)\big) = -5$

d. None of the others

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Question 15

Select the function(s) from $\mathbb{R}$ to $\mathbb{R}$ below which is(are) linear maps:

a. $f : x \longmapsto \sin(x)$

b. $g : x \longmapsto 2x$

c. $h : x \longmapsto x^2$

d. $k : x \longmapsto e^x$

e. None of these functions is a linear map

Question 16

Let E and F be two $\mathbb{R}$-vector spaces and f a linear map from E to F. Let $u \in E$. Then:

a. $u \in \text{Ker}(f) \iff f(u) = 0_E$

b. $u \in \text{Ker}(f) \iff f(u) = 0_F$

c. $u \in \text{Ker}(f) \iff f(u) = u$

d. None of the others

Question 17

Let E and F be two $\mathbb{R}$-vector spaces and f a linear map from E to F.

Then $\text{Im}(f) = \{f(u), u \in E\}$.

a. True

b. False

Question 18

Consider a linear map $f : \mathbb{R}^3 \longrightarrow \mathbb{R}^3$ such that $\text{Ker}(f) = \{(x, y, z) \in \mathbb{R}^3, x = y = -z\}$. Then:

a. $\text{Ker}(f) = \text{Span}\big((1, 1, 1)\big)$

b. $\text{Ker}(f) = \text{Span}\big((1, 1, -1)\big)$

c. $\text{Ker}(f) = \{0_{\mathbb{R}^3}\}$

d. None of the others

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Question 19

Consider a linear map $f : \mathbb{R}^3 \longrightarrow \mathbb{R}^3$ such that $\text{Ker}(f) = \{(x, y, z) \in \mathbb{R}^3, x = 0\}$. Then:

a. $\text{Ker}(f)$ is a line in $\mathbb{R}^3$

b. $\text{Ker}(f)$ is a plane in $\mathbb{R}^3$

c. $\big((0, 1, 1)\big)$ is a basis of $\text{Ker}(f)$

d. $(1, 0, 0) \in \text{Ker}(f)$

e. None of the others

Question 20

Consider the linear map $f : \begin{array}{ccc} \mathbb{R}^2 & \longrightarrow & \mathbb{R} \\ (x, y) & \longmapsto & x + y \end{array}$. Then:

a. $3 \in \text{Ker}(f)$

b. $3 \in \text{Im}(f)$

c. $(1, 1) \in \text{Ker}(f)$

d. $(1, 1) \in \text{Im}(f)$

e. None of the others

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Questions 21 to 30 might have more than one correct answers.

21. Which of the following phases is/are called condensed ?

A, B

a. Liquid
b. Solid
c. Gas
d. Fluid

22. The density of air is approximately

B

a. 0,1 g/L
b. 1 g/L
c. 10 g/L
d. 100 g/L

23. On a microscopic scale, if we look at the water molecules on the surface of a lake (under normal conditions of temperature and pressure), we can say that the molecules

B

a. Are immobile.
b. Move continuously.

24. The mathematical formula that connects force with pressure is:

B

a. $d\vec{F} = P\,ds$
b. $d\vec{F} = P\,d\vec{s}$
c. $d\vec{F} = m.g\,d\vec{s}$
d. $d\vec{P} = F\,d\vec{s}$

25. Which of the following state variables is/are extensive?

C; D

a. Pressure
b. Temperature
c. Volume
d. Mass

26. Which of the following state variables are intensive?

A, B

a. Pressure
b. Temperature
c. Volume
d. Mass

27. The ideal gas law is:

A

a. PV = nRT
b. PT = nRV
c. PR = nVT
d. TV = nRP

28. Consider a car tire filled with an ideal gas. The initial pressure is 2 bars. After a 200 km trip, the car tires heat up. We can say that, on arrival,

B, D

a. The tire pressure is equal to 2 bars.
b. The tire pressure is bigger than 2 bars.
c. The tire pressure is smaller than 2 bars.
d. The amount of gas inside the tire has not changed.

29. Energy is a physical quantity than is measured in

B

a. kg
b. J
c. m
d. N

30. 100g of air in a closed container is heated up by 5 kJ. The specific heat capacity of water is approximately 1000 $J.K^{-1}.kg^{-1}$. The change in temperature is:

C

a. 5K
b. 0,5K
c. 50K
d. 500K