ALGO
MCQ

Consider the binary tree AB=$\{1, 2, 3, 5, 6, 7, 10, 11, 13, 15, 26\}$ represented using the hierarchical numbering.

1. **AB is a binary tree ?**
   (a) degenerate
   (b) complete
   (c) perfect
   (d) proper
   (e) nothing in particular

2. **The height of the tree AB is ?**
   (a) 2
   (b) 3
   (c) 4
   (d) 5
   (e) 6

3. **The internal and "complete" path lengths of AB are equal to ?**
   (a) $10, 14$
   (b) $11, 24$
   (c) $13, 24$
   (d) $11, 13$
   (e) $11, 26$

4. **The depth of the node 13 of AB is equal to ?**
   (a) 0
   (b) 1
   (c) 2
   (d) 3
   (e) 4

5. **The postorder traversal, of the tree AB, is ?**
   (a) $1, 2, 5, 10, 11, 3, 6, 13, 26, 7, 15$
   (b) $2, 10, 5, 11, 1, 6, 26, 13, 3, 7, 15$
   (c) $10, 11, 5, 2, 26, 13, 6, 15, 7, 3, 1$
   (d) $1, 2, 3, 5, 6, 7, 10, 11, 13, 15, 26$

Consider the general tree AG:

$< A, < B, < E, < L, \emptyset >, < M, \emptyset >>, < F, \emptyset >, < G, < N, \emptyset >, < O, \emptyset >>,$
$< H, \emptyset >>, < C, < I, \emptyset >>, < D, < J, < P, \emptyset >, < Q, \emptyset >>, < K, \emptyset >>>$

Where the letters are the nodes and where $\emptyset = empty forest$

6. **The depth of the nodes G and K of the tree AG is ?**
   (a) 0
   (b) 1
   (c) 2
   (d) 3
   (e) 4

7. **The path length of the tree AG is ?**
   (a) 9
   (b) 17
   (c) 21
   (d) 26
   (e) 35

8. **The postorder traversal of the tree AG is ?**
   (a) $A, B, E, L, M, F, G, N, O, H, C, I, D, J, P, Q, K$
   (b) $L, M, E, F, N, O, G, H, B, I, C, P, Q, J, K, D, A$
   (c) $A, B, C, D, E, F, G, H, I, J, K, L, M, N, O, P, Q$

9. **How many orders does the depth-first traversal of a general tree induce ?**
   (a) 1
   (b) 2
   (c) 2 and a half
   (d) 3
   (e) 4

10. **The height of a general tree that has only a root node is?**
    (a) -1
    (b) 0
    (c) 1

MCQ 5

Monday, 26 February

Question 11

Select the correct answer(s)

a. $\mathbb{R}^3$ is a $\mathbb{R}$-vector space.

b. $\mathbb{R}[X]$ is a $\mathbb{R}$-vector space.

c. The set of all the increasing real sequences is a $\mathbb{R}$-vector space.

d. The set $\{f : \mathbb{R} \longrightarrow \mathbb{R}, f(0) = 1\}$ is a $\mathbb{R}$-vector space.

e. None of the others

Question 12

Let E be a $\mathbb{R}$-vector space and F a linear subspace of E. Then:

a. $0_E \in F$

b. $\forall (u, v) \in E^2, u + v \in F$

c. $\forall (u, v) \in F^2, u + v \in F$

d. None of the others

Question 13

Consider the set $E = \{(x, y, z) \in \mathbb{R}^3,\ x + y + z = 1\}$.

a. E is a plane of $\mathbb{R}^3$

b. E is a line of $\mathbb{R}^3$

c. E is a linear subspace of $\mathbb{R}^3$

d. E is not a linear subspace of $\mathbb{R}^3$

Question 14

Consider the set $E = \{(x, y, z) \in \mathbb{R}^3,\ xy^3 = 0\}$.

a. $(1, 0) \in E$

b. $0_{\mathbb{R}^3} \in E$

c. E is a linear subspace of $\mathbb{R}^3$

d. E is a line of $\mathbb{R}^3$

e. None of the others

3

Question 15

In $\mathbb{R}^3$, consider the vectors $u = (1, 0, 0)$, $v = (0, -1, 1)$ and $w = (2, -2, 2)$. Then:

a. w is a linear combination of u and v.

b. w is not a linear combination of u and v.

Question 16

In $\mathbb{R}^3$, consider the vectors $u = (1, 0, 0)$ and $v = (0, 0, 1)$

a. u is a linear combination of u and v.

b. $(0, 1, 0)$ is a linear combination of u and v.

c. $(0, 0, 0)$ is a linear combination of u and v.

d. None of the others

Question 17

Let E be a $\mathbb{R}$-vector space, F and G two linear subspaces of E. Then:

a. $F \cap G$ is a linear subspace of E.

b. $F \cup G$ is a linear subspace of E.

c. None of the others

Question 18

Let E be a $\mathbb{R}$-vector space, F and G two linear subspaces of E and $u \in E$. The property "$u \in F + G$" means that:

$$\exists (u_1, u_2) \in F \times G \text{ such that } u = u_1 + u_2$$

a. True

b. False

Question 19

In $\mathbb{R}^2$, consider $F = \{(x, y) \in \mathbb{R}^2,\ x = 0\}$ and $G = \{(x, y) \in \mathbb{R}^2,\ y = 0\}$. Then:

a. $(1, 0) \in F$

b. $(0, 1) \in G$

c. $(1, 1) \in F + G$

d. $(3, 0) \in F \cap G$

e. None of the others

4

Question 20

To get the points at this question, select all the answers except the last one!

a. To prepare

b. my B3 exams

c. first of all, I review the lecture

d. **THEN I REVIEW THE TUTORIALS (TD)**

e. Oops! I did not read the whole text of the question :(

5

For questions 21-30, there may exist more than one correct answers.

21. Kinematics is the branch of physics that studies
    a. Motion, independently of its cause.
    b. The causes of motion.
    c. Cinema.
    d. None of the above.

22. A material point is
    a. A very small object.
    b. A system whose spatial dimensions can be neglected.
    c. A system whose rotation around itself can be neglected.
    d. None of the above.

23. The Earth can be considered a material point when studying
    a. Its rotation around its own axis.
    b. Its rotation around the Sun.

24. In the polar coordinate system, the position vector can be written as:
    a. $\overrightarrow{OM} = r.\overrightarrow{u_r}$
    b. $\overrightarrow{OM} = \begin{pmatrix} r \\ 0 \end{pmatrix}$
    c. $\overrightarrow{OM} = \begin{pmatrix} 0 \\ r \end{pmatrix}$
    d. $\overrightarrow{OM} = \begin{pmatrix} r \\ \theta \end{pmatrix}$

25. If $\vec{v}.\vec{a} > 0$, then
    a. The two vectors point towards the same direction.
    b. The two vectors point towards opposite directions.
    c. The motion is accelerated.
    d. Only the trajectory changes.

26. Consider a point M that is moving according to the equations: $\begin{cases} x(t) = 5\cos(2t) \\ y(t) = 5\sin(2t) \end{cases}$

a. The components of the velocity vector are constant.
b. The norm of the velocity vector is constant.
c. The motion is uniform.
d. The acceleration is zero.

27. For the same point M:

a. The trajectory is rectinlinear.
b. The trajectory is circular.
c. The trajectory is elliptical.
d. The trajectory is sinusoidal.

28. Consider a point M moving on a trajectory given by $y = -5x^2 + 4x$. The ground is assumed to be the x-axis.

a. Point M hits the ground at x = 5 and x = -4.
b. Point M hits the ground at x = -5 and x = 4.
c. Point M hits the ground at x = 0 and x = $\frac{4}{5}$.
d. Point M hits the ground at x = 0 and x = $\frac{2}{5}$.

29. In the case of uniform circular motion, we can say that:

a. $\dot{\theta} = 0$
b. $\ddot{\theta} = 0$
c. $\dot{r} = 0$
d. $\ddot{r} = 0$

30. The acceleration vector in polar coordinates is written as:

$$\vec{a} = (\ddot{r} - r\dot{\theta}^2)\overrightarrow{u_r} + (2\dot{r}\dot{\theta} + r\ddot{\theta})\overrightarrow{u_\theta}$$

In the case of a uniform circular motion, we can say that:

a. $\vec{a} = 0$
b. $\vec{a} = (-r\dot{\theta}^2)\overrightarrow{u_r} + (r\ddot{\theta})\overrightarrow{u_\theta}$
c. $\vec{a} = (-r\dot{\theta}^2)\overrightarrow{u_r}$
d. $\vec{a} = (\ddot{r} - r\dot{\theta}^2)\overrightarrow{u_r} + (2\dot{r}\dot{\theta})\overrightarrow{u_\theta}$