CPSC 453 – Self-test – Oct 7-8, 2019

1) Who developed the first interactive computer animation system:

☐ Ivan Sutherland at MIT

☐ Alvy Ray Smith At the University of Utah

√ Marceli Wein and Nestor Burtnyk at the NRC

2) What is the value of $\tan\left(\frac{\pi}{4}\right)$? 1

3) Which of the following operation(s) is/are commutative:

√ Vector addition

☐ Vector subtraction

√ Dot Product

☐ Cross product

√ Multiplication of a vector by a number.

4) Does the equality $\vec{a}\times(\vec{b}\times\vec{c}) = (\vec{a}\times\vec{b})\times\vec{c}$ hold for any vectors $\vec{a}, \vec{b}, \vec{c}$? Some vectors? Never? Justify your answer.

Does not hold for all vectors, e.g. if $\vec{a}$ is perpendicular to $\vec{b} = \vec{c}$.
Holds in some cases, e.g. when one of the argument vectors is 0, or if the three vectors are perpendicular to each other (in which case the results is also 0)

5) Consider vectors defined as follows:

```
struct V3f
{
        float x, y, z;
        V3f(float x1, float y1, flat z1)
                {x=x1; y=y1; z = z1}
        V3f()
                {x=0; y=0; z=0}
};
```

Define the overloaded operator * for computing the dot product of two vectors in C++.

```
float operator*(V3f a, V3f b)
{
        return (a.x*b.x + a.y*b.y + a.z*b.z);
}
```

6) Write the transformation matrix for rotating by angle α around the y axis in 3D.

$$\begin{bmatrix} \cos\alpha & 0 & \sin\alpha \\ 0 & 1 & 0 \\ -\sin\alpha & 0 & \cos\alpha \end{bmatrix}$$

7) Point P has homogeneous coordinates $[1 \;\; 2 \;\; 3 \;\; 4]^T$. What are its x, y, z coordinates in 3D?

$$(0.25, 0.5, 0.75)$$

7) Which of the following operation(s) can be performed as matrix multiplication without using homogeneous coordinates:

☐ Translation
√ Scaling with respect to the origin of the coordinate system
√ Parallel projection
☐ Perspective projection
√ Rotation with respect to the origin of the coordinate system

8) What is Rodrigues's formula for?

Rotation about an arbitrary axis.

9) What are the normalized device coordinates (NDC)?

Coordinates within the canonical view volume, bound by planes $x = -1, x = 1;\; y = -1, y = 1;\; z = -1, z = 1$.

10) Oblique projections are a special case of:

☐ Orthographic projections
√ Parallel projections
☐ One-point perspective
☐ Two-point perspective
☐ Three-point perspective