CPSC 1301, Computer Science I Final Examination

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Introduction

This activity consists of Python programming exercises in five parts with 16 separate questions. The following exercises are open book and open note. You are free to use any written documentation you wish. These are group exercises, and you can consult with each other in writing your programs.

You are a tentmaker. You want to maximize the inner space of the tent relative to the amount of material required for the tent. Calculate the ratio of the surface area to the volume for the following shapes. Format all floats to three decimal places. Each question is worth 6.25 points, see section 6.

Your deliverable is a text file on CougarView. It should contain the text of your code and the output. Sample output follows below in section 6. Answer this question: *What is the most efficient shape (according to the dimensions given) of the ratio of surface area to volume?*

1 Tent Making - Cube

Compute the ratio for the cube. Use $side = 6$. See figure 1.

$$volume = s^3 \tag{1}$$

$$surface = s^2 \times 6 \tag{2}$$

$$ratio = \frac{surface}{volume} \tag{3}$$

where $s =$ the length of the side of the cube

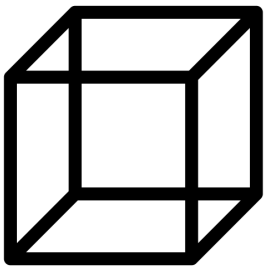

Figure 1: Cube

2 Tent Making - Hemisphere

Compute the ratio for the hemisphere. Use $radius = 4$. See figure 2.

$$volume = \frac{\frac{4}{3}\pi r^3}{2} \tag{4}$$

$$surface = \frac{3\pi r^2}{2} \tag{5}$$

$$ratio = \frac{surface}{volume} \tag{6}$$

where r = the radius of the sphere

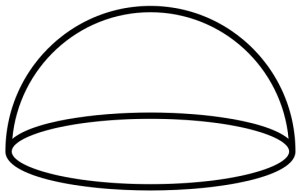

Figure 2: Hemisphere

3 Tent Making - TeePee (Cone)

Compute the ratio for the cone. Use $height = 4$ and $radius = 4$. See figure 3.

$$volume = \frac{\pi r^2 h}{3} \tag{7}$$

$$basesurface = \pi r^2 \tag{8}$$

$$surface = \frac{basesurface \times h}{3} \tag{9}$$

$$ratio = \frac{surface}{volume} \tag{10}$$

where h = height and r = the radius of the base

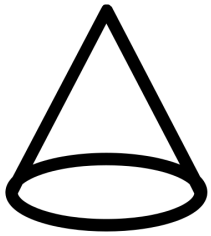

Figure 3: Cone

4 Tent Making - Pup Tent (Prism)

Compute the ratio for the prism. Use $height = 4$ and $side = 6$. See figure 4.

$$volume = \left(\frac{sh}{2}\right) \cdot s \tag{11}$$

$$endarea = \frac{sh}{2} \tag{12}$$

$$basearea = s \cdot s \tag{13}$$

$$sidearea = s \cdot \sqrt{h^2 + \left(\frac{s}{2}\right)^2} \tag{14}$$

$$surface = 2 \cdot endarea + basearea + 2 \cdot sidearea \tag{15}$$

$$ratio = \frac{surface}{volume} \tag{16}$$

$$\tag{17}$$

where h = height and s = the side of the base

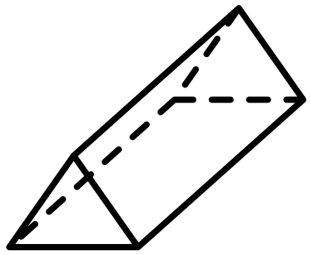

Figure 4: Prism

5 Tent Making - Pyramid

Compute the ratio for the pyramid. Use $height = 4$ and $side = 6$. See figure 5.

$$volume = \frac{s^2 h}{3} \tag{18}$$

$$basearea = s^2 \tag{19}$$

$$slopearea = \frac{\sqrt{h^2 + s^2} \cdot s}{2} \tag{20}$$

$$surface = 4 \cdot slopearea + basearea \tag{21}$$

$$ratio = \frac{surface}{volume} \tag{22}$$

$$\tag{23}$$

where h = height and s = the side of the base

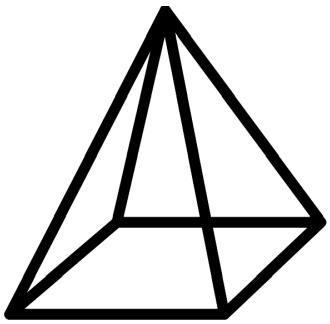

Figure 5: Pyramid

6 Deliverable

Your deliverable is a text file on CougarView. It should contain the text of your code and the output. Sample output follows below. Please note the formatting requirement.

```
CUBE: making a tent shaped like a cube
Please enter the side of the cube: 6
1. the volume is ?
2. the area is ?
3. the ratio of area to volume is ?

HEMISPHERE: making a tent shaped like a hemisphere
Please enter the radius of the sphere: 4
4. the volume is ?
5. the area is ?
6. the ratio of area to volume is ?

CONE: making a tent shaped like a cone
Please enter the height of the cone: 4
Please enter the radius of the base: 4
7. the volume is ?
8. the area is ?
9. the ratio of area to volume is ?

PRISM: making a tent shaped like a prism
Please enter the height of the prism: 4
Please enter the side of the base: 6
10. the volume is ?
11. the area is ?
12. the ratio of area to volume is ?

PYRAMID: making a tent shaped like a pyramid
Please enter the height of the pyramid: 4
Please enter the side of the base: 6
13. the volume is ?
14. the area is ?
15. the ratio of area to volume is ?

16. The most efficient shape is ?
```