Exercise 7

Write the program, which reads parameters of a 3D shape from the input file and writes its properties to the output file:

1. Each line of the input file has the following format: <shape-name> <shape-parameters>. <shape-name> can take the following values:
    a. "Ball". In this case, <shape-parameters> is the string containing 4 white-space separated numbers O_x, O_y, O_z, R, and the shape represents the ball with the center in point (O_x, O_y, O_z) and radius R.
    b. "Tetrahedron". In this case, <shape-parameters> is the string containing 12 white-space separated numbers $p_x^1, p_y^1, p_z^1,\ p_x^2, p_y^2, p_z^2,\ p_x^3, p_y^3, p_z^3,\ p_x^4, p_y^4, p_z^4$, and the shape represents the tetrahedron with vertices $(p_x^1, p_y^1, p_z^1),\ (p_x^2, p_y^2, p_z^2),\ (p_x^3, p_y^3, p_z^3),\ (p_x^4, p_y^4, p_z^4)$.
2. Each line of the output file corresponds to the line in the input file and should contain two numbers:
    a. The volume of the shape (up to the 6th decimal place).
    b. The area of the orthogonal projection of the shape onto a plane with normal (n_x, n_y, n_z) (up to the 6th decimal place).
3. The program should take 5 command line arguments: the input file name, the output file name, n_x, n_y, n_z.
4. All computations should be done using double precision floating point numbers.
5. **It should be possible to add the support of a new shape to the program without any modification of the existing source code** (i.e. only by adding new files and modifying CMakeLists.txt).

Example input:

```
Ball 5 5 5 1
Tetrahedron  0 0 0  1 0 0  0 1 0  0 0 1
Ball 2 3 4 2
```

Example output for $(n_x, n_y, n_z) = (0,0,1)$:

```
4.188790 3.141593
0.166667 0.500000
33.510322 12.566371
```