A função Bolhas é a função responsável por gerar os pontos com seus raios e aplicar 2 processos de “finning” sobre eles.
1° finning: garantir que as bolhas não tem interseção entre si.
2° finning: garantir que as bolhas não ultrapassem o limite do cilindro em que se encontram.

Inputs:
n = número de bolhas desejado
raio = raio do cilindro
h = altura do cilindro

bolhar[[1]] = “time of arrival”, valores sorteados de forma uniforme entre 0 e 1 que indicam a ordem de eliminação das bolhas nos “finning”s
bolhas[[2]] = números que indicam ordem de chegada de cada bolha gerada
bolhas[[3]] = coordenadas x, y e z de cada bolha
bolhas[[4]] = raios de cada bolha
bolhas[[5]] = os valores de Rzone de cada bolha (é importante para a aplicação do 2°finning)

```
Bolhas[n_, raio_, h_] :=
 (bubbles = {{}, {}, {}, {}, {}};

  numero = RandomVariate[PoissonDistribution[n]];
           variável aleatória   distribuição de Poisson
  For[j = 0, j <  numero, j++;
  para cada
   Rzone = raio * Sqrt[RandomReal[1]];
                  raiz···  real aleatório
   θ = RandomReal[2 π];
       real aleatório
   xvalue = Rzone Cos[θ];
                  cosseno
   yvalue = Rzone Sin[θ];
                  seno
   zvalue = RandomReal [{0, h}];
            real aleatório
   rvalue = RandomReal[{0.01, 1.01}];
            real aleatório
   u = RandomReal[{0, 1}];
       real aleatório
   t = j;

   AppendTo[bubbles[[3]], {xvalue, yvalue, zvalue}];
   adiciona a
   AppendTo[bubbles[[4]], rvalue]; AppendTo[bubbles[[1]], u];
                                   adiciona a
   AppendTo[bubbles[[2]], t]; AppendTo[bubbles[[5]], Rzone];];
                              adiciona a

  bubbles = SortBy[bubbles^T, First]^T;
            ordena por      primeiro
```

```
                ordena por          primeiro
For[k = 1, k < Length[bubbles[[1]]] - 1, k++,
                comprimento
 For[l = k + 1, l < Length[bubbles[[1]]], l++,
                    comprimento
  Δx = bubbles[[3, k, 1]] - bubbles[[3, l, 1]];
  Δy = bubbles[[3, k, 2]] - bubbles[[3, l, 2]];
  Δz = bubbles[[3, k, 3]] - bubbles[[3, l, 3]];
  If[√(Δx^2 + Δy^2 + Δz^2) < (bubbles[[4, k]] + bubbles[[4, l]]),
  se
   bubbles = Delete[#, {l}] & /@ bubbles]]];
             deleta

For[i = 1, i < Length[bubbles[[1]]], i++,
para cada       comprimento
 Which[bubbles[[3, i, 3]] < bubbles[[4, i]], bubbles = Delete[#, {i}] & /@ bubbles,
 retorna o p···                                deleta
  bubbles[[3, i, 3]] + bubbles[[4, i]] > h, bubbles = Delete[#, {i}] & /@ bubbles,
                                              deleta
  bubbles[[5, i]] + bubbles[[4, i]] > raio, bubbles = Delete[#, {i}] & /@ bubbles]];
                                              deleta
Print[bubbles];
apresenta o resultado
Print[numero];
apresenta o resultado
Print[Length[bubbles[[1]]];)
      comprimento
```

In[6]:=
```
Bolhas[100, 9.5, 76]
```

{{0.0248794, 0.043153, 0.052652, 0.0684909, 0.0822838, 0.104274, 0.125012, 0.130266, 0.132048,
  0.148499, 0.151295, 0.152027, 0.154084, 0.156667, 0.184305, 0.221467, 0.222198, 0.227202,
  0.251261, 0.255821, 0.26227, 0.269979, 0.270647, 0.295877, 0.306361, 0.307962, 0.324721,
  0.335434, 0.337303, 0.344639, 0.346659, 0.349741, 0.365032, 0.398362, 0.399389, 0.41149,
  0.415453, 0.44554, 0.471067, 0.471632, 0.482517, 0.48792, 0.493206, 0.502308, 0.506278,
  0.546561, 0.547544, 0.585512, 0.607598, 0.61624, 0.625748, 0.630989, 0.638044, 0.662231,
  0.667731, 0.668286, 0.673348, 0.690733, 0.695875, 0.700972, 0.708533, 0.712673,
  0.713594, 0.713728, 0.729715, 0.743422, 0.750346, 0.764087, 0.804337, 0.831326,
  0.856666, 0.866264, 0.875099, 0.878943, 0.884188, 0.884509, 0.891156, 0.89274, 0.896006,
  0.906453, 0.914967, 0.916699, 0.985837, 0.989643, 0.989745, 0.996225, 0.99819},
 {28, 41, 57, 49, 70, 37, 65, 20, 23, 56, 40, 51, 3, 2, 1, 82, 6, 34, 43, 63, 42, 17, 35,
  25, 72, 30, 66, 77, 73, 38, 68, 79, 45, 48, 71, 12, 58, 27, 19, 62, 76, 54, 26, 80,
  46, 33, 75, 7, 21, 47, 64, 16, 9, 83, 44, 87, 32, 22, 60, 8, 85, 18, 11, 5, 39, 52,
  81, 10, 86, 50, 67, 13, 55, 14, 78, 29, 74, 84, 24, 69, 53, 31, 4, 61, 15, 36, 59},
 {{-4.26171, 1.4006, 19.45}, {2.38458, 0.483366, 26.7691}, {-0.670351, 1.84065, 48.4625},
  {-7.5721, 4.01874, 30.0978}, {7.8007, 4.79825, 36.3911}, {0.605914, 0.816298, 44.7998},
  {-0.290612, 4.0388, 30.2026}, {-3.22883, 6.14405, 19.3882}, {3.87863, 2.90712, 75.4418},
  {5.65245, -3.86713, 58.9857}, {0.120024, -3.49184, 56.3768}, {-3.97662, 3.06558, 56.3358},
  {-4.62493, -0.867547, 0.724517}, {2.14551, 6.98045, 22.9583}, {5.01713, 4.32826, 74.8282},
  {3.76235, -6.5401, 26.2874}, {7.74034, -2.33929, 48.7018}, {-2.5105, 9.07717, 38.0912},
  {-5.84878, -6.75351, 31.5788}, {-4.74093, 6.84546, 42.4946}, {0.0807895, -3.60965, 4.34551},
  {-6.8574, -3.38021, 68.3937}, {2.01796, -6.70061, 5.43282}, {6.01584, -1.89207, 54.5791},
  {0.122384, 2.33064, 45.9761}, {5.57046, 1.50366, 3.3616}, {4.57517, -6.70811, 37.542},
  {2.89027, -1.72129, 67.521}, {-2.08716, 6.97904, 38.8159}, {7.12221, 2.41633, 22.7894},
  {6.05031, 0.162413, 8.52983}, {1.08914, -0.85807, 31.5176}, {5.36333, 6.24896, 8.832},
  {3.81119, -1.46405, 21.1287}, {4.24165, -0.184102, 29.8887}, {-7.03944, -2.34861, 40.9252},
  {-3.70387, 4.57703, 40.7095}, {7.74142, 3.79138, 1.00316}, {-8.15788, 1.61066, 31.0063},
  {0.0407847, 4.18204, 11.1787}, {-5.97822, -2.36988, 66.645}, {-7.93243, -2.51112, 50.2167},
  {-3.38119, 6.52438, 25.5562}, {4.03266, -0.712875, 66.043}, {7.38673, 1.47139, 46.6223},
  {2.97494, -6.61976, 43.1364}, {4.64969, 0.917913, 37.22}, {-9.27, -1.69695, 50.6284},
  {3.25369, 3.74949, 64.1016}, {-1.11131, -4.65857, 53.8415}, {-6.20172, -1.90456, 70.3463},
  {-0.137288, 8.63455, 0.228552}, {-7.06493, 6.1443, 66.0179}, {-3.29633, 3.93243, 32.5315},
  {-4.44412, -1.25833, 12.9512}, {-6.36439, 2.99542, 29.4526}, {-2.165, 2.94001, 33.2615},
  {7.78562, 3.83922, 14.9146}, {8.18586, 1.16937, 68.7959}, {7.09976, 6.12339, 41.9161},
  {4.64003, -7.47505, 43.8246}, {3.40209, 6.02171, 12.4597}, {-0.0541974, 6.86125, 57.0866},
  {-5.19371, 3.90798, 49.9213}, {6.45751, 0.834408, 43.0351}, {8.49977, 1.42647, 6.66374},
  {4.38753, -7.2196, 70.39}, {4.06571, -7.00924, 51.0996}, {-4.12577, 8.35763, 58.1231},
  {-6.61559, 2.1645, 65.8059}, {1.87855, 8.33192, 71.019}, {-1.5991, -0.674496, 58.6033},
  {-4.79187, 3.15167, 51.455}, {0.251775, 3.61595, 23.6701}, {0.889859, 6.76864, 24.4812},
  {-0.770782, -1.41931, 35.555}, {0.547857, 6.12411, 7.53044}, {-2.5036, -3.33138, 8.15877},
  {-5.83699, -3.15157, 54.0284}, {3.27546, -4.8045, 8.63101}, {4.81945, -7.65621, 17.9822},
  {2.03004, 2.35467, 47.5269}, {2.77671, 8.63631, 13.9733}, {5.33368, -7.00991, 34.6017},
  {2.04873, 3.23979, 32.8477}, {3.73608, -4.7954, 33.5351}, {6.4998, 0.209692, 63.5222}},
 {0.219858, 0.110285, 0.881879, 0.251809, 0.366721, 0.776041, 0.2707, 0.244202, 0.434568,
  0.638086, 0.931534, 0.850181, 0.487383, 0.803612, 0.171436, 0.094938, 0.700526, 0.741343,
  0.127878, 0.288611, 0.646893, 0.213736, 0.153687, 0.231992, 0.672282, 0.0199218,
  0.859344, 0.299135, 0.132867, 0.883865, 0.76282, 0.992257, 0.644332, 0.0484512, 0.326407,
  0.514792, 0.341042, 0.284365, 0.924887, 0.660812, 0.933327, 0.243759, 0.0619657,
  0.576751, 0.166761, 0.72319, 0.327735, 0.317562, 0.610208, 0.448897, 0.698715, 0.6418,
  0.412801, 0.964317, 0.638782, 0.235492, 0.660152, 0.213596, 0.326196, 0.466975, 0.657776,
  0.403204, 0.461214, 0.828233, 0.502252, 0.106109, 0.983916, 0.674675, 0.425901, 0.99947,
  0.849787, 0.378849, 0.384747, 0.141883, 0.421204, 0.980505, 0.920316, 0.290937, 0.960215,
  0.891078, 0.143586, 0.844238, 0.499262, 0.0513446, 0.68022, 0.053279, 0.739929}}

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In[ ]:=
```
list = {{1, 2, 3}, {{4, 5, 6}, {7, 8, 9}, {10, 11, 12}}, {0, 1, 2}, {3, 4, 5}};
Delete[#, {{2}, {3}}] & /@ list
deleta
```

Out[ ]=
```
{{1}, {{4, 5, 6}}, {0}, {3}}
```

In[ ]:=
```
list
```

Out[ ]=
```
{{1, 2, 3}, {a, b, c}, {{1, 2, 3}, {5, 6, 7}}}
```

In[ ]:=
```
{{1, 2, 3}, {a, b, c}, {{1, 2, 3}, {5, 6, 7}}}
```

Out[ ]=
```
{{1, 2, 3}, {a, b, c}, {{1, 2, 3}, {5, 6, 7}}}
```