Student Information

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Answer 1

a)

0.1164 is the probability that the total weight of all the cargo unloaded at the port in a day exceeds 300000 tons. It is not high but is not low, too.

b)

Expected total weight I found is 260004.12, which is less than 30000. There is a correlation between the probability I found in part a).

c)

Standard deviation I found is 33974.84, which is less than the difference between the expected total weight and weight I found, meaning the accuracy of the X is very high.

```
octave:1> source("hw4.m")
Estimated probability: 0.1164
Expected weight: 260004.12 tons
Standard deviation: 33974.84 tons
```

Figure 1: Outputs

```
% bulk carriers
lambda_bulk = 50;
alpha_bulk = 60;
lambda_bulk_weight = 0.1;

% container ships
lambda_container = 40;
alpha_container = 100;
lambda_container_weight = 0.05;

% oil tankers
lambda_tanker = 25;
alpha_tanker = 120;
lambda_tanker_weight = 0.02;

weight_threshold = 300000;

n_simulations = ceil(0.25 * (norminv(0.99)/0.03)^2);

bulk_storage = zeros(n_simulations, 1);
container_storage = zeros(n_simulations, 1);
tanker_storage = zeros(n_simulations, 1);
weight_storage = zeros(n_simulations, 1);

count_exceed_threshold = 0;

for i = 1:n_simulations
```

```
28  % random sampling part
29
30  U_bulk = rand;
31  U_container = rand;
32  U_tanker = rand;
33
34  bulk_count = 0;
35  p_bulk = exp(-lambda_bulk);
36  F_bulk = p_bulk;
37
38  while U_bulk >= F_bulk
39    bulk_count = bulk_count + 1;
40    p_bulk = p_bulk * lambda_bulk / bulk_count;
41    F_bulk = F_bulk + p_bulk;
42  end
43
44  container_count = 0;
45  p_container = exp(-lambda_container);
46  F_container = p_container;
47
48  while U_container >= F_container
49    container_count = container_count + 1;
50    p_container = p_container * lambda_container / container_count;
51    F_container = F_container + p_container;
52  end
53
54  tanker_count = 0;
```

```
55    p_tanker = exp(-lambda_tanker);
56    F_tanker = p_tanker;
57
58    while U_tanker >= F_tanker
59      tanker_count = tanker_count + 1;
60      p_tanker = p_tanker * lambda_tanker / tanker_count;
61      F_tanker = F_tanker + p_tanker;
62    end
63
64    bulk_storage(i) = bulk_count;
65    container_storage(i) = container_count;
66    tanker_storage(i) = tanker_count;
67
68    total_weight = 0;
69
70    for j = 1:bulk_count
71      weights = -1 / lambda_bulk_weight * log(rand(alpha_bulk, 1));
72      total_weight = total_weight + sum(weights);
73    end
74
75    for j = 1:container_count
76      weights = -1 / lambda_container_weight * log(rand(
           alpha_container, 1));
77      total_weight = total_weight + sum(weights);
78    end
79
80    for j = 1:tanker_count
```

```
81      weights = -1 / lambda_tanker_weight * log(rand(alpha_tanker, 1)
            );
82      total_weight = total_weight + sum(weights);
83    end
84
85    weight_storage(i) = total_weight;
86    if total_weight > weight_threshold
87      count_exceed_threshold = count_exceed_threshold + 1;
88    end
89  end
90
91  estimated_probability = count_exceed_threshold / n_simulations;
92  expected_weight = mean(weight_storage);
93  std_weight = std(weight_storage);
94
95  fprintf('Estimated probability: %.4f\n', estimated_probability);
96  fprintf('Expected weight: %.2f tons\n', expected_weight);
97  fprintf('Standard deviation: %.2f tons\n', std_weight);
```