Social Networks Analysis Assignment

```
fileID = fopen('sx-stackoverflow.txt','r');
formatSpec = '%d %d %d';
sizeA = [3 3000];
Data = fscanf(fileID,formatSpec,sizeA);
Data = Data';
```

Enter the number of distinct time frames

```
N = 4
```

```
N = 4
```

```
Pgd = 5
```

```
Pgd = 5
```

```
Pcn = 5
```

```
Pcn = 5
```

```
Pjc = 5
```

```
Pjc = 5
```

```

Pa = 5
```

```
Pa = 5
```

```

Ppa = 5
```

```
Ppa = 5
```

1ο ερώτημα

```
startTime = min(Data(:,3))
```

```
startTime = 1.2176e+09
```

```
endTime = max(Data(:,3))
```

```
endTime = 1.2186e+09
```

2ο ερώτημα

```
Timestamps = zeros(1,N+1);
for i = 1:1:N+1
    Timestamps(i) = startTime + i*((endTime-startTime)/(N+1));
end
```

```
Timestamps
```

```
Timestamps = 1×5
10^9 ×
    1.2178    1.2180    1.2182    1.2184    1.2186
```

3ο ερώτημα

```
Graphs = {digraph};

for i = 2:1:N
    Graphs{end+1} = digraph;
end

len = size(Data,1);

for i = 1:1:len
    k=1;
    for j = Timestamps(2:end)

        if Data(i,3) < j

            Graphs{k} = addedge(Graphs{k},int2str(Data(i,1)),int2str(Data(i,2)));
            break
        end
        k = k+1;
    end

end

numnodes(Graphs{1})
```

```
ans = 208
```

```
numnodes(Graphs{2})
```

```
ans = 322
```

```
numnodes(Graphs{3})
```

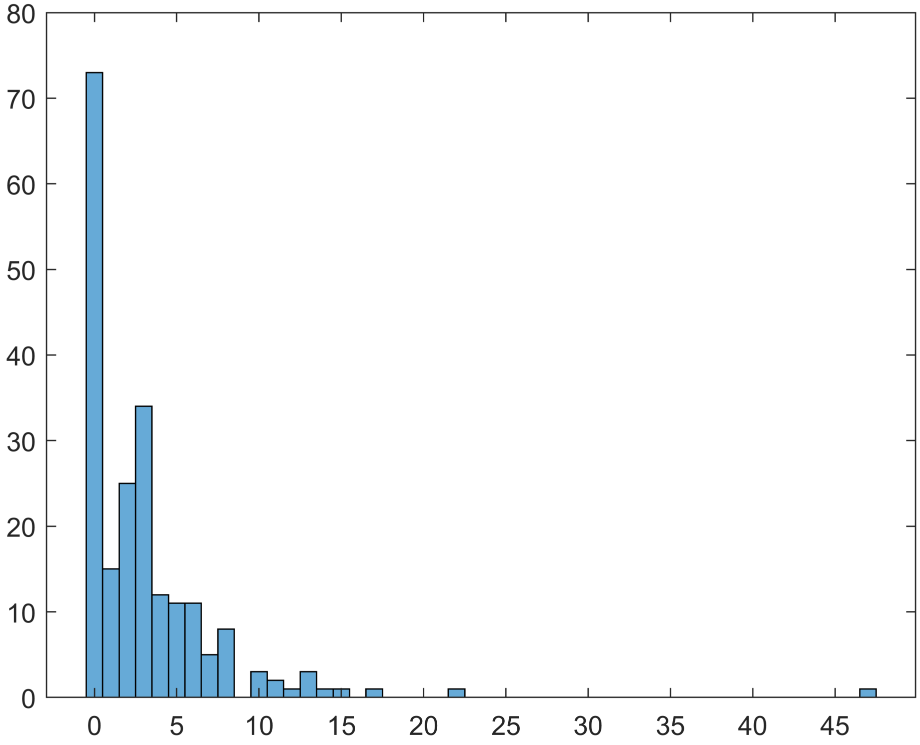
```
ans = 292
```

```
numnodes(Graphs{4})
```

```
ans = 342
```

4ο ερώτημα

```
for i = 1:1:N

    indegree_ranks = centrality(Graphs{i},'indegree');
    histogram(indegree_ranks)
    figure()
    outdegree_ranks = centrality(Graphs{i},'outdegree');
    histogram(outdegree_ranks)
    figure()

    degree_ranks = indegree_ranks+outdegree_ranks;
    histogram(degree_ranks)
    figure()

    incloseness_ranks = centrality(Graphs{i},'incloseness');
    histogram(incloseness_ranks)
    figure()

    outcloseness_ranks = centrality(Graphs{i},'outcloseness');
    histogram(outcloseness_ranks)
    figure()

    betweenness_ranks = centrality(Graphs{i},'betweenness');
    histogram(betweenness_ranks)
    figure()

    %eigenvector centrality
    A = full(adjacency(Graphs{i}));
    [V,D] = eig(A.');
    [~,idx] = max(diag(D));
    ec = abs(V(:,idx));
    eigenvector_ranks = reshape(ec, length(ec), 1);
    histogram(eigenvector_ranks)
    figure()


    %katz centrality
    [l1,idx] = max(diag(D));
    ec = abs(V(:,idx));
    a = 1/ceil(l1);
    I = eye(size(A.'));
    katz_ranks = (inv(I-a*A.')-I)*ones(size(A,1),1);
    histogram(katz_ranks(:,1))
    figure()


    disp('graph')
end
```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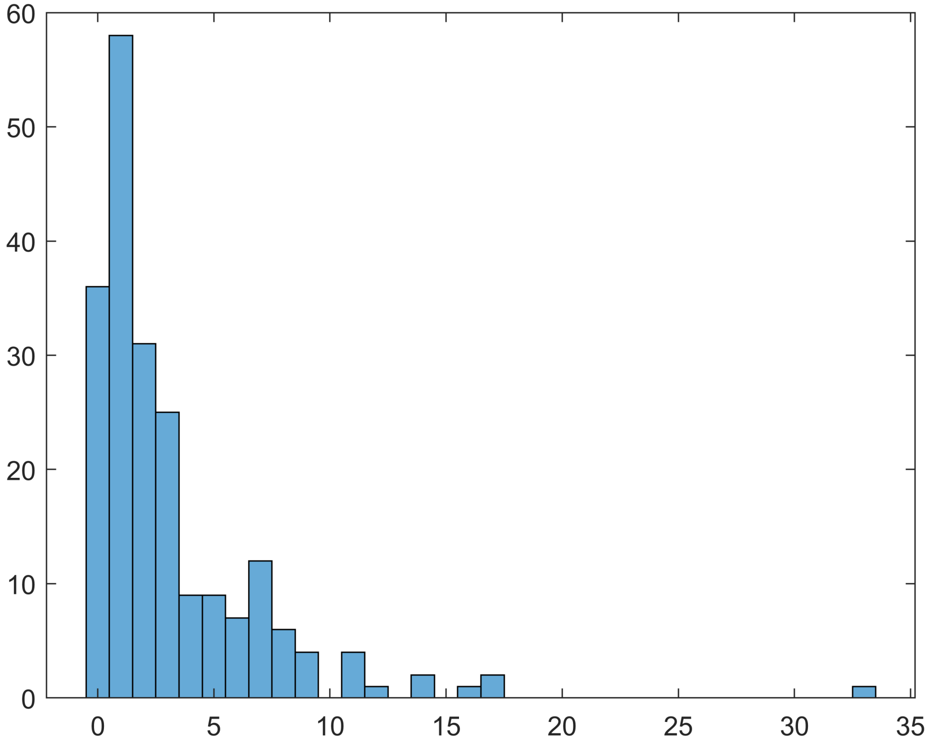
40
45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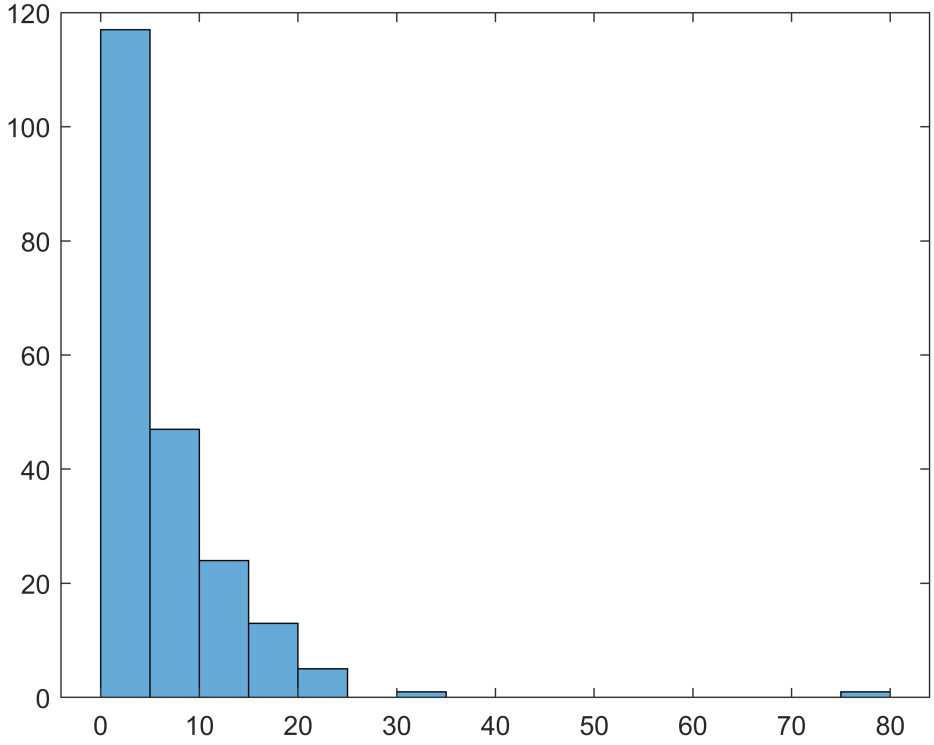
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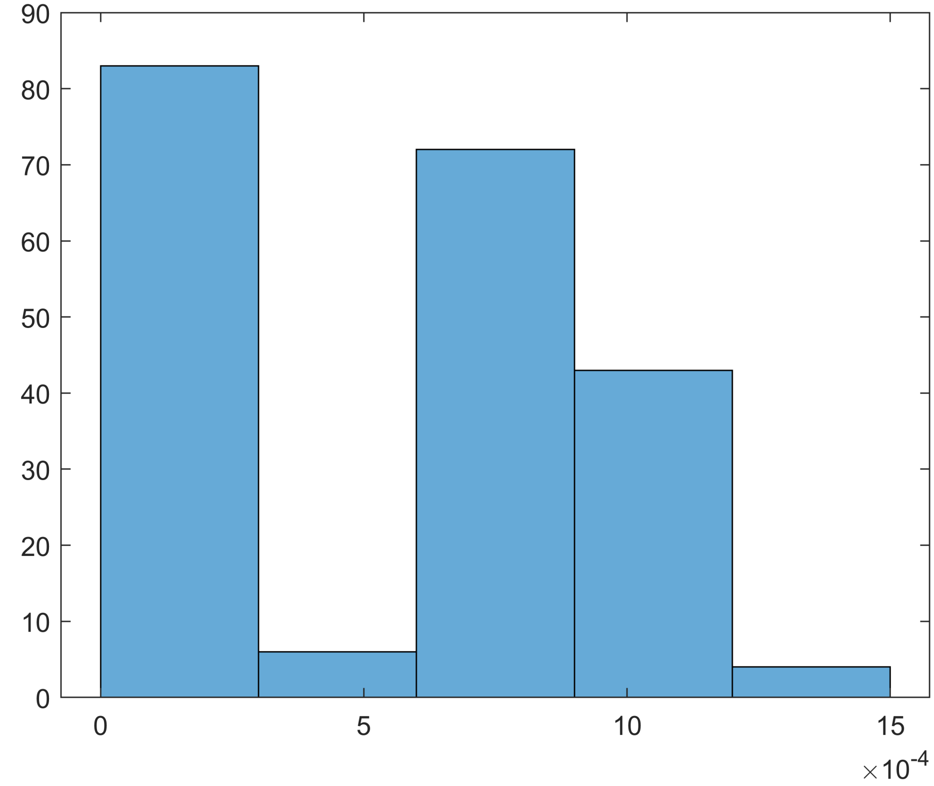
90
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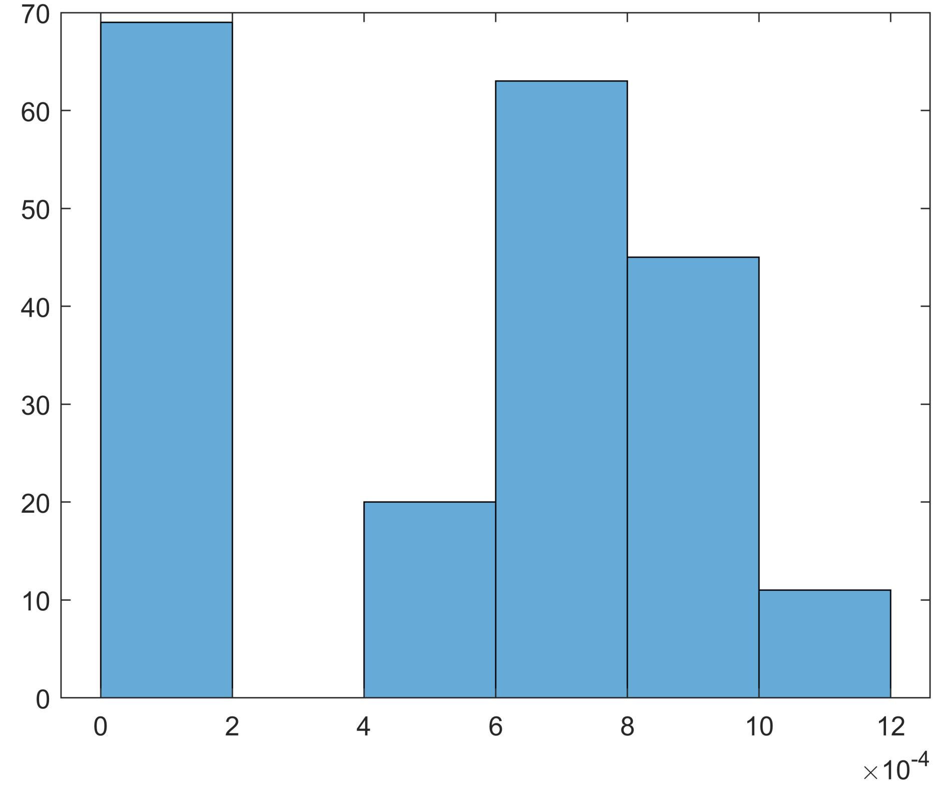
×10^{-4}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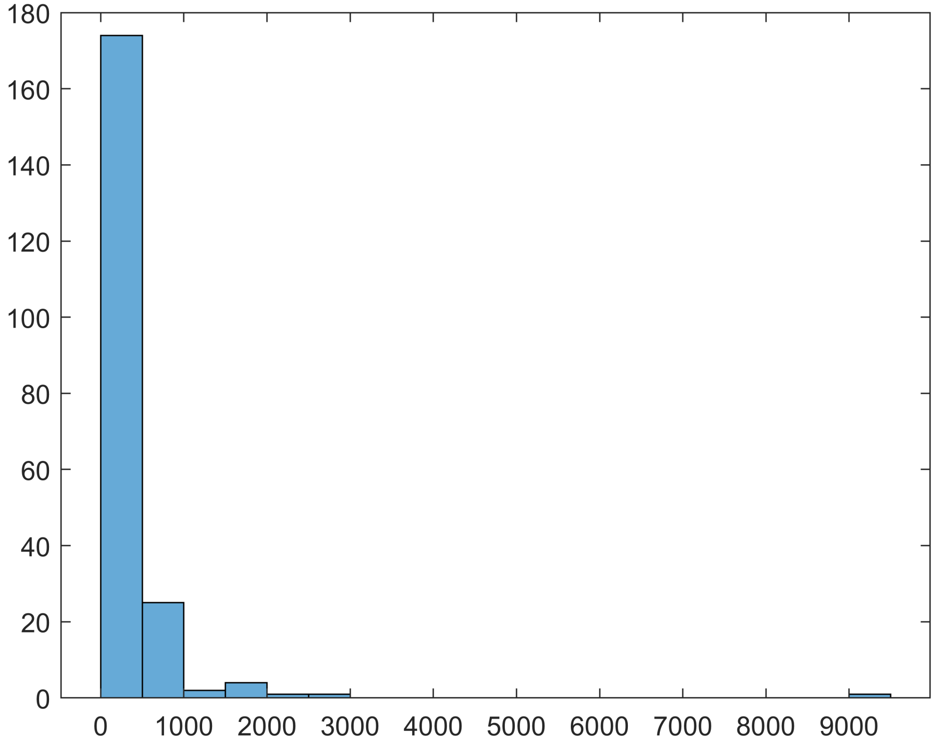
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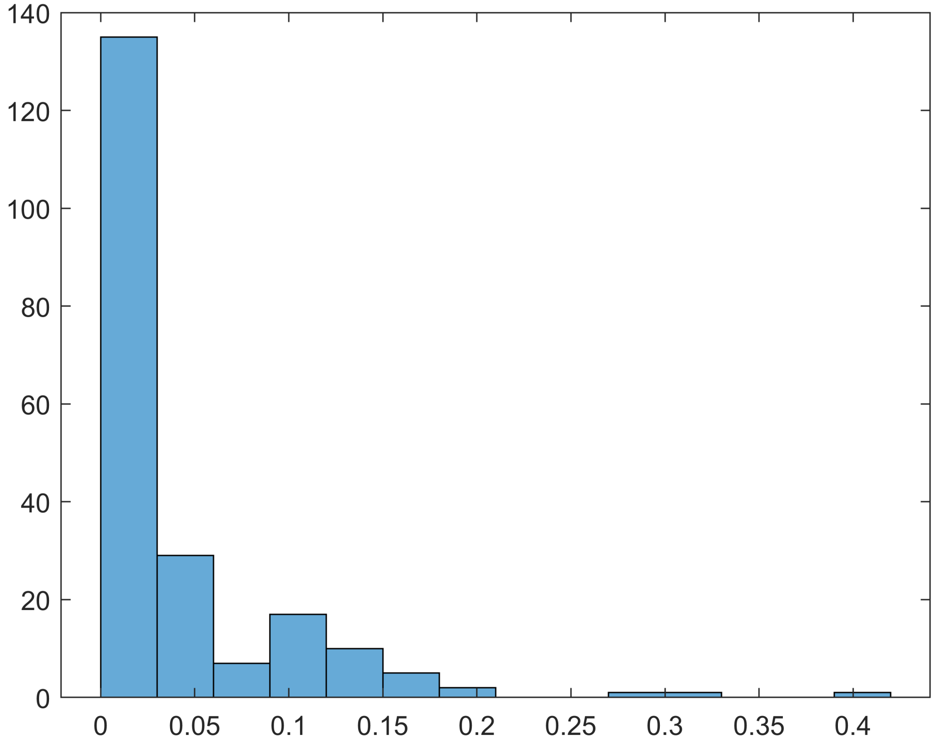
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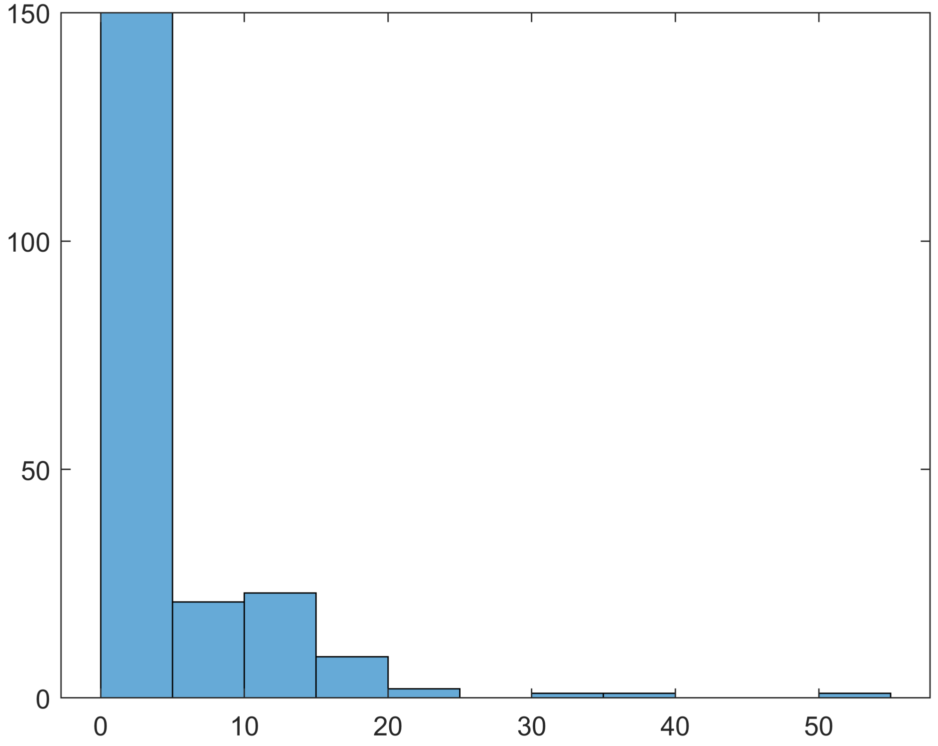
150
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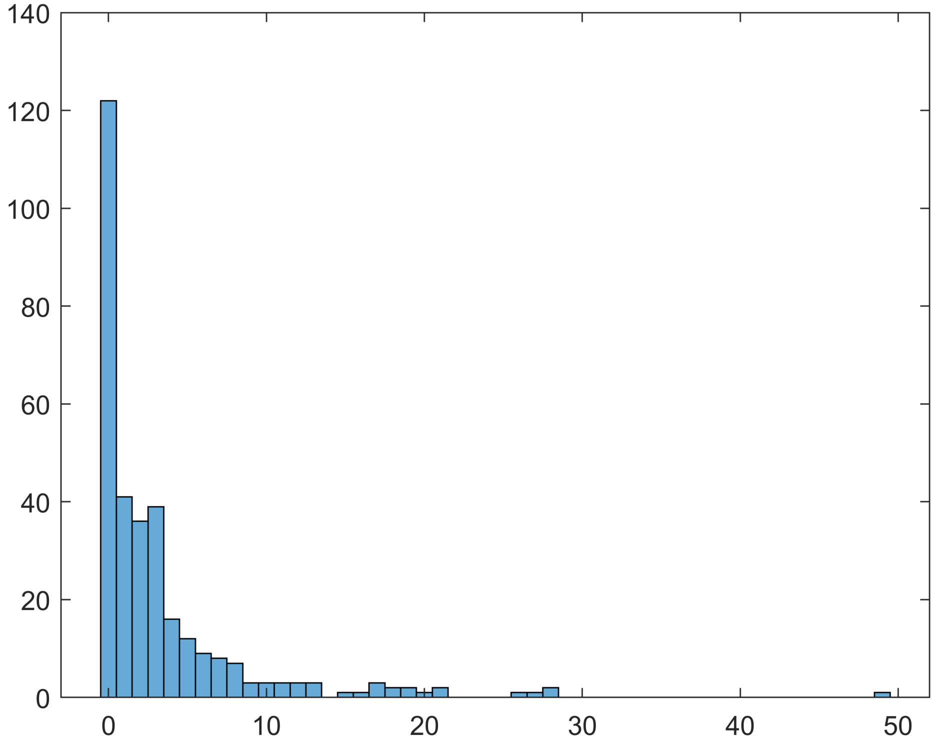
graph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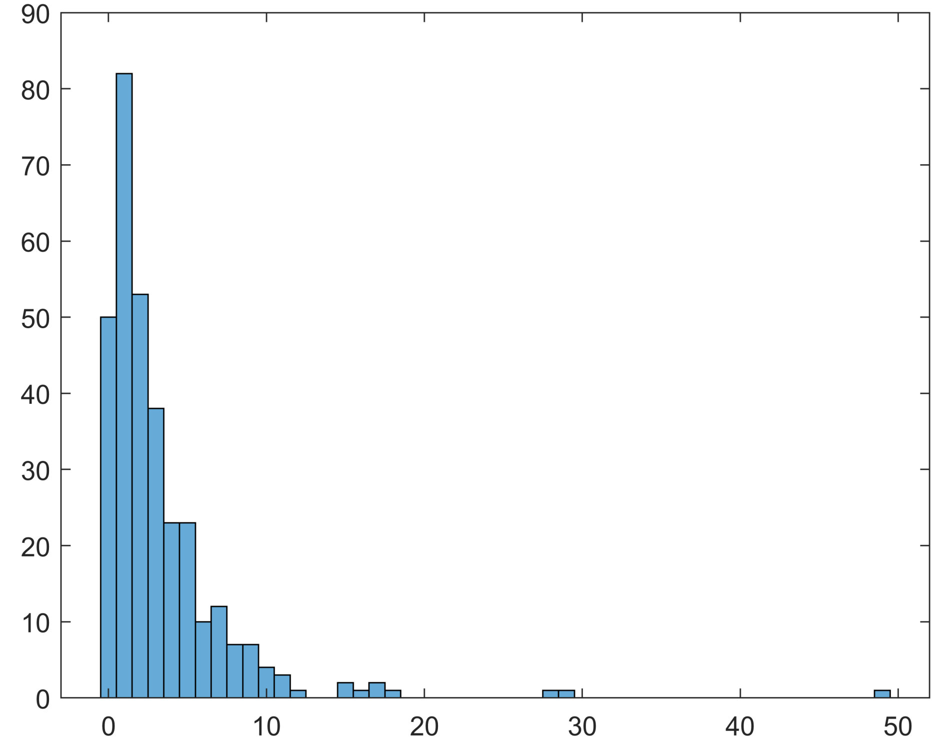
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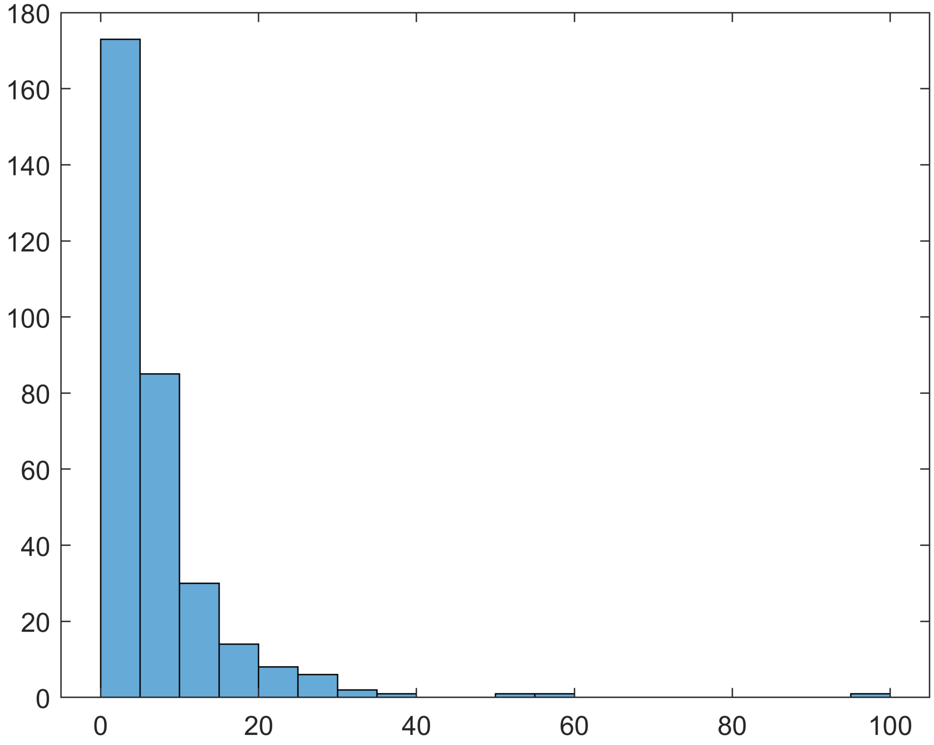
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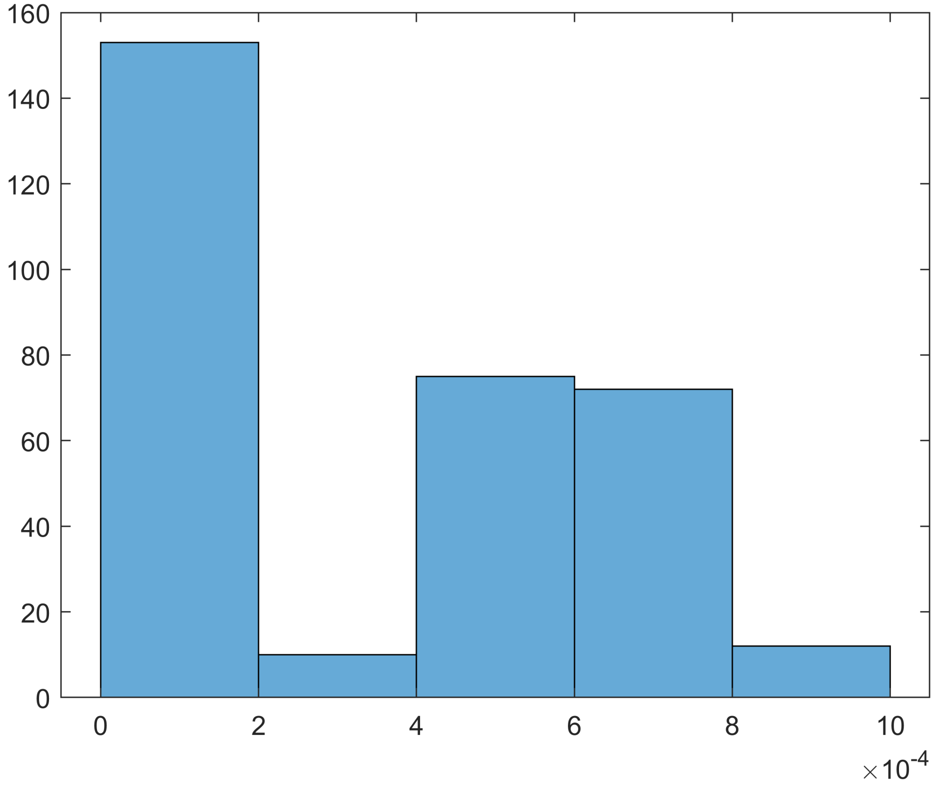
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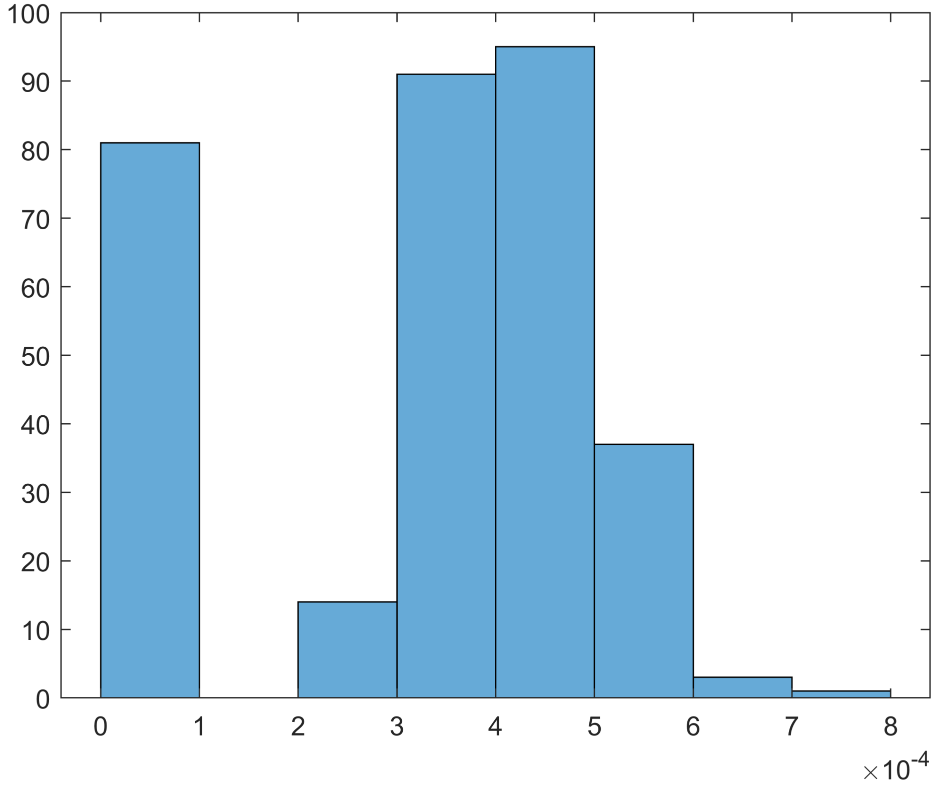
$\times 10^{-4}$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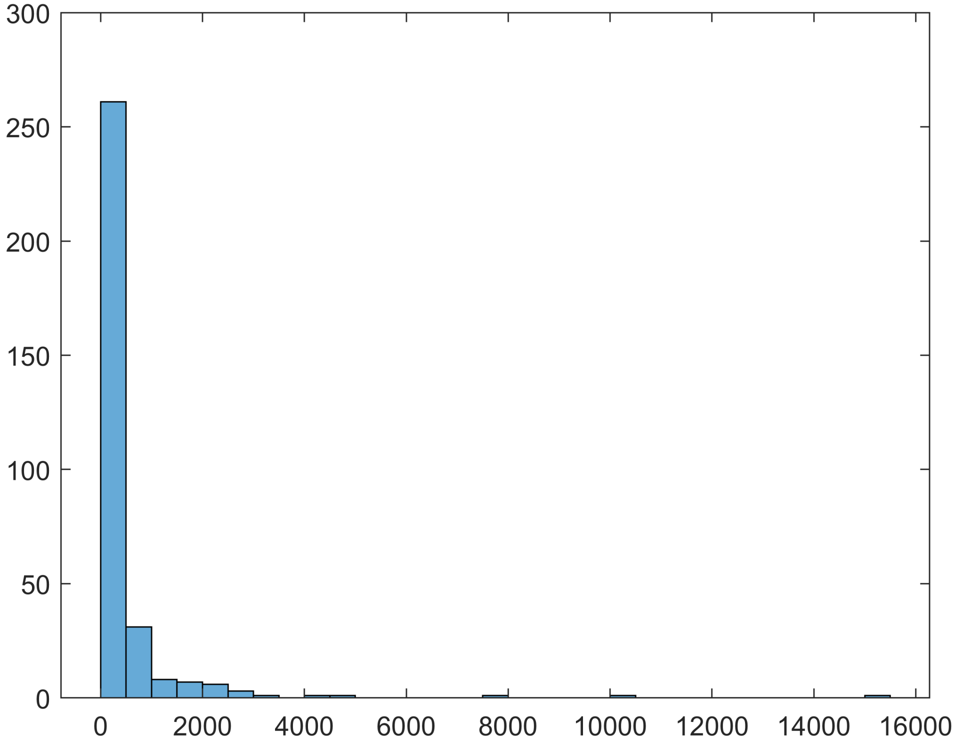
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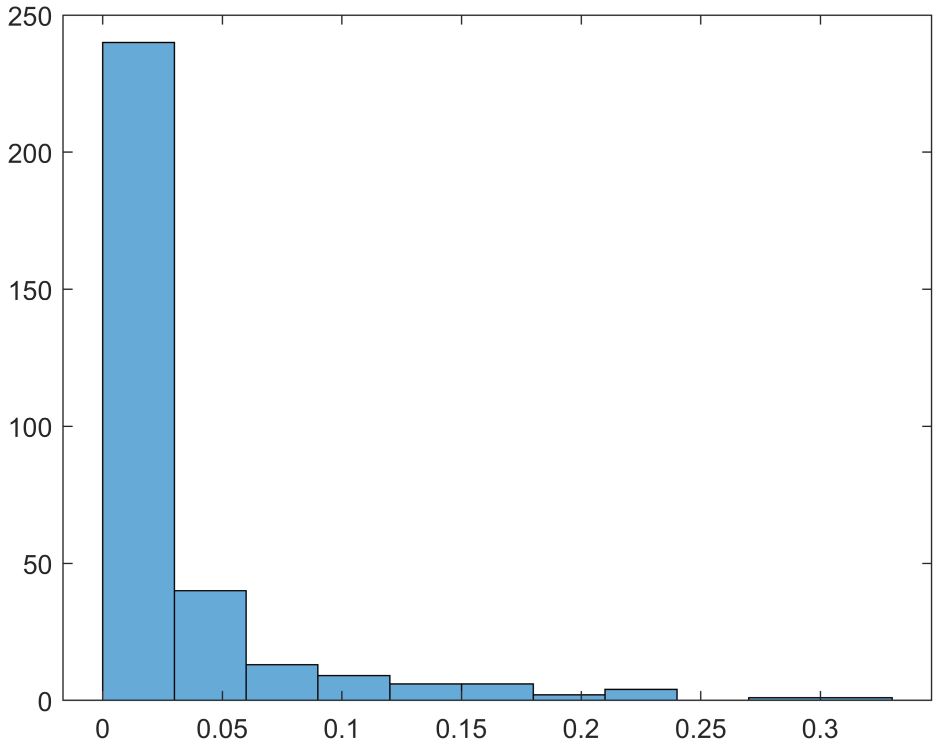
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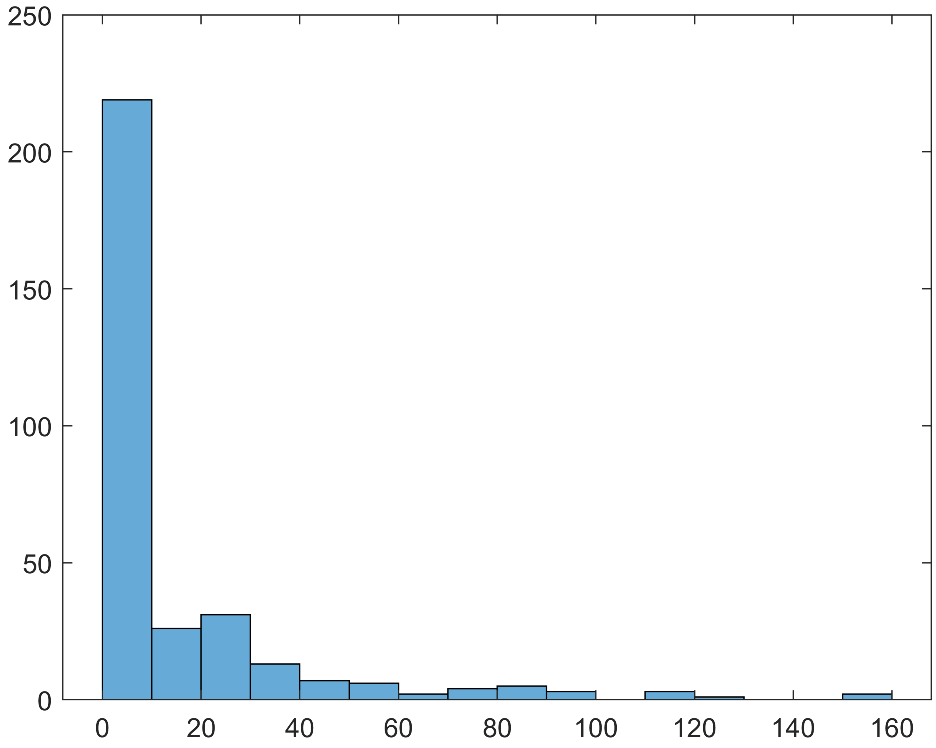
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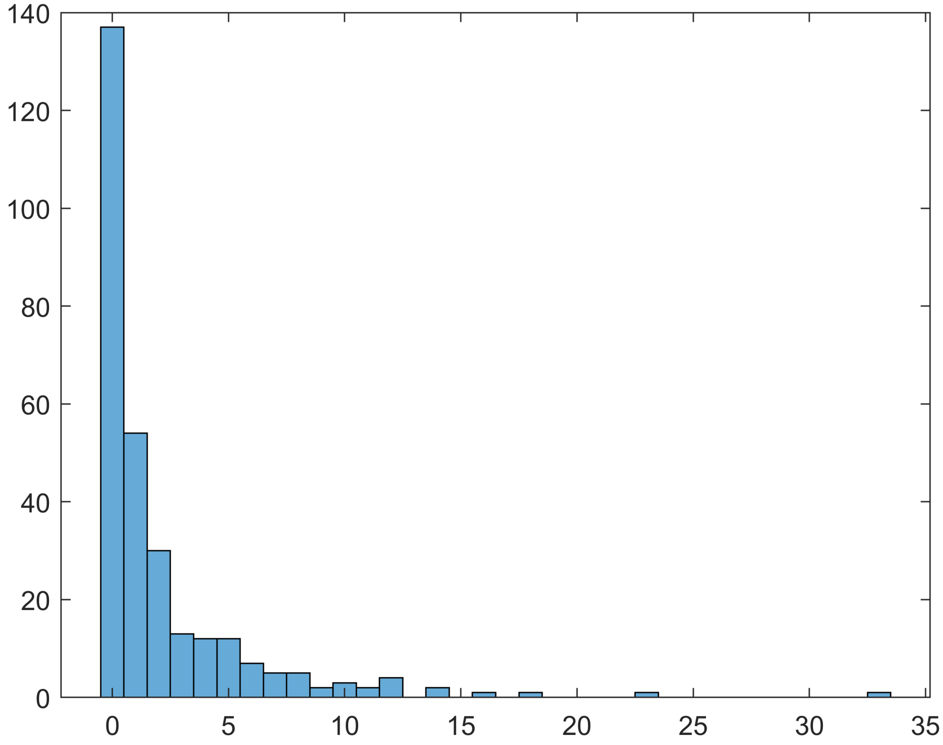
160

graph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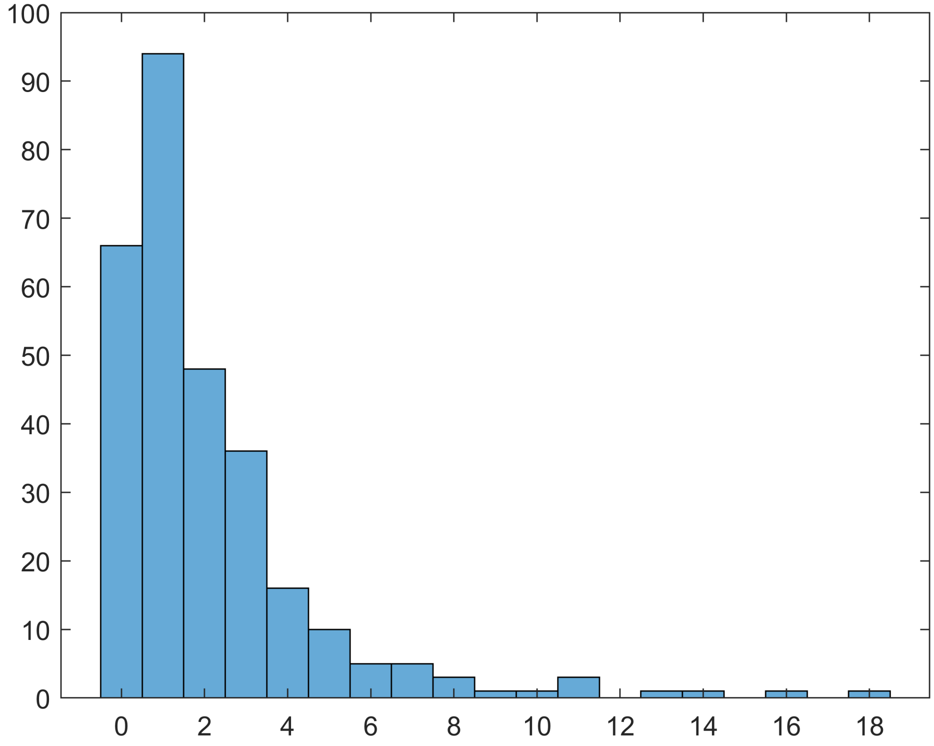
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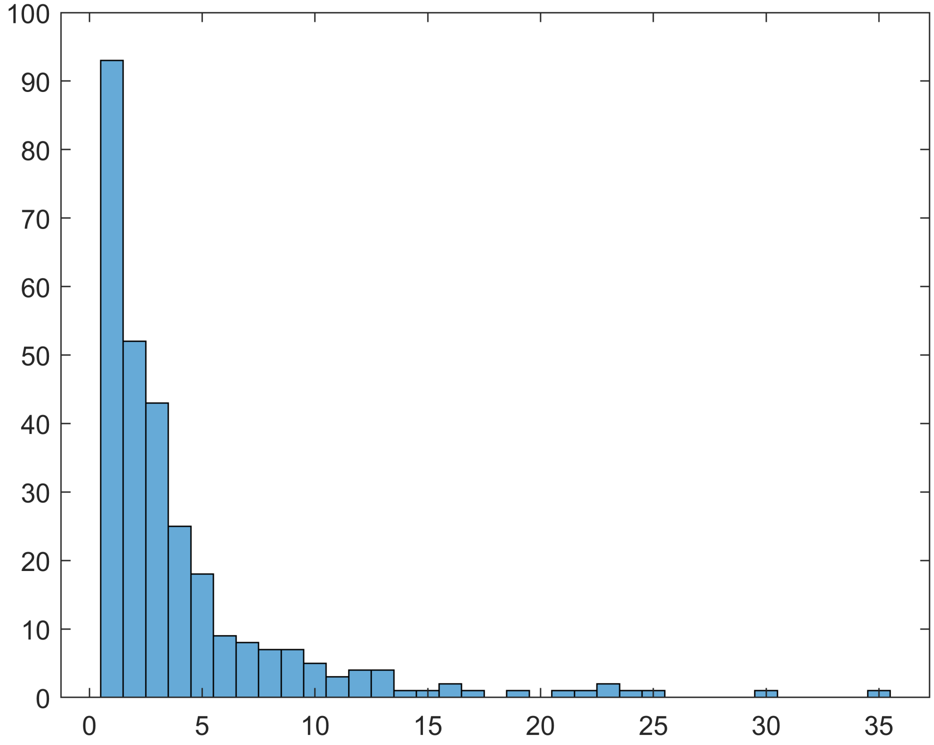
18



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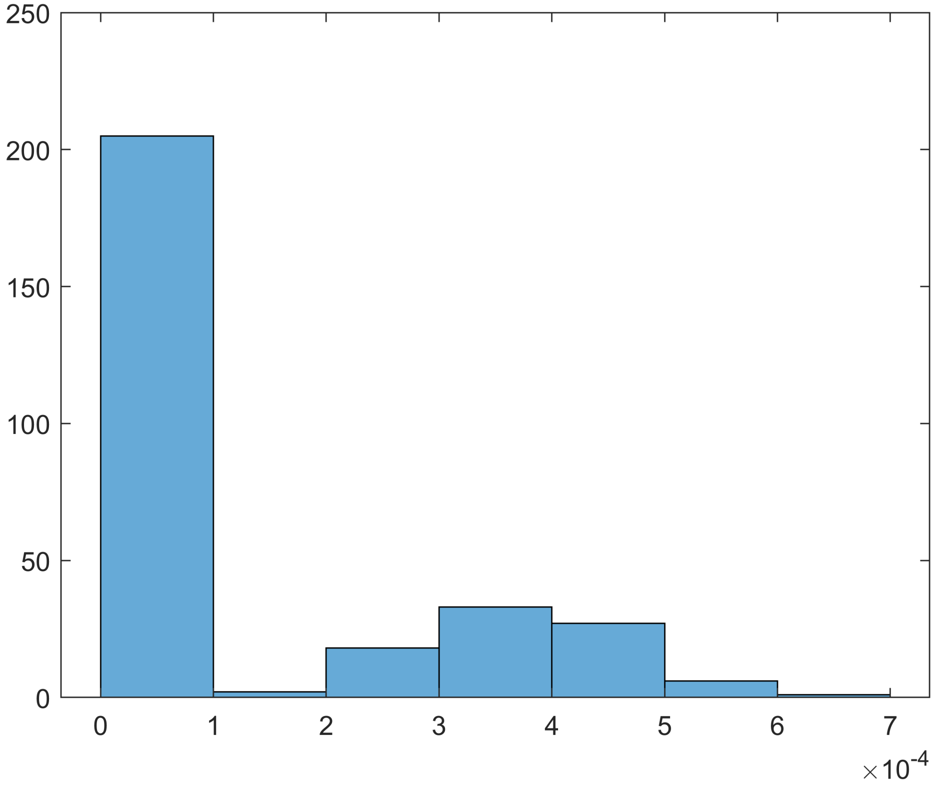

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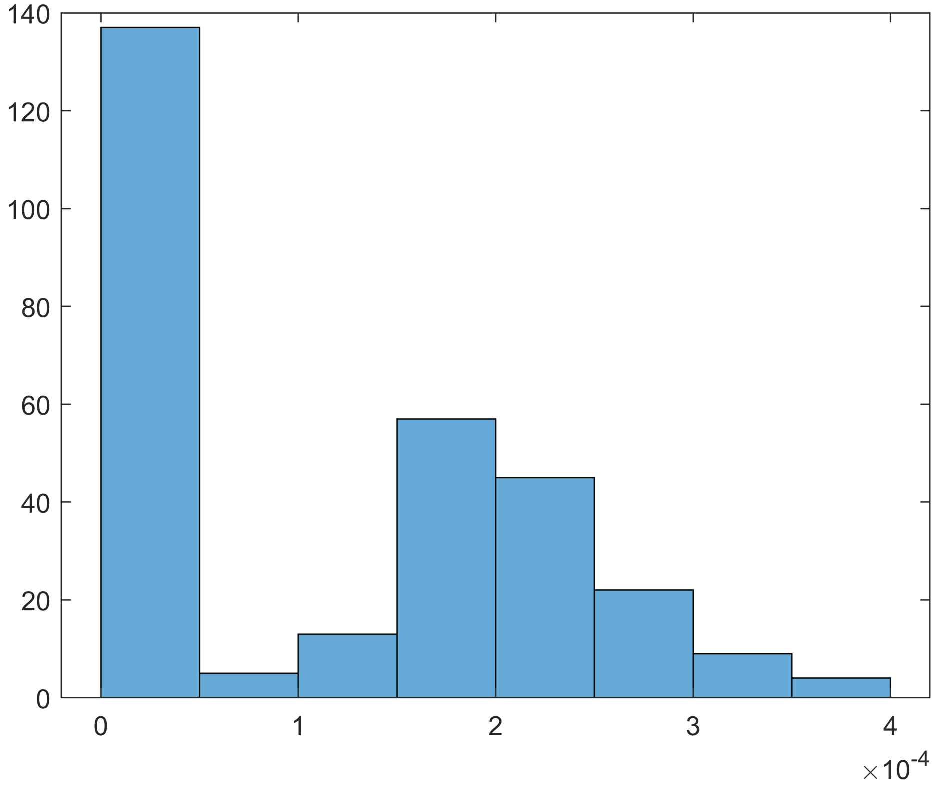
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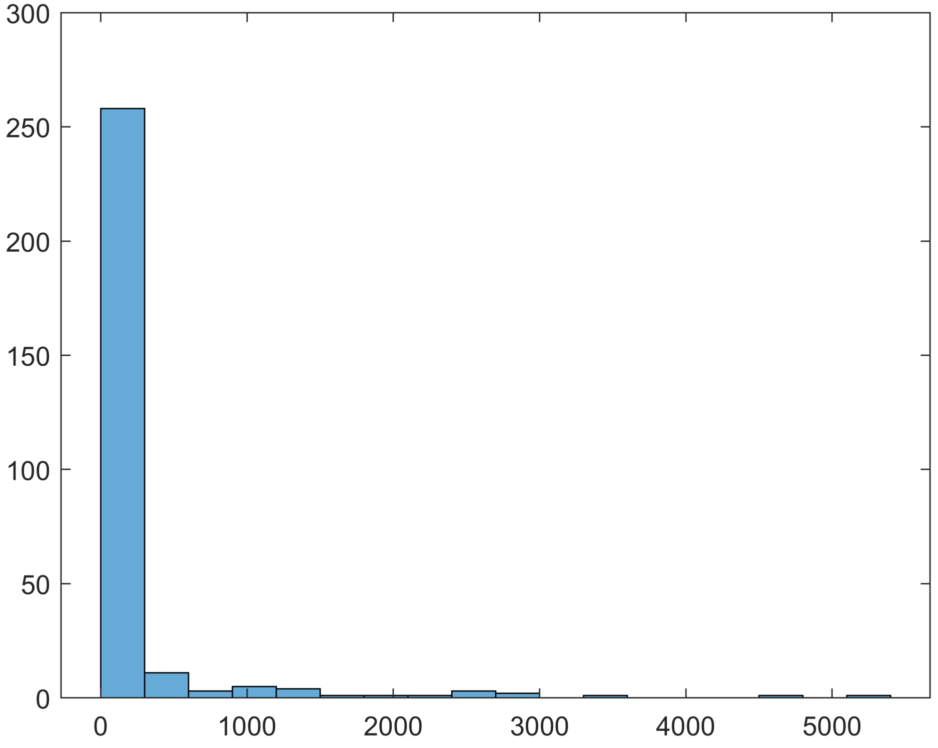
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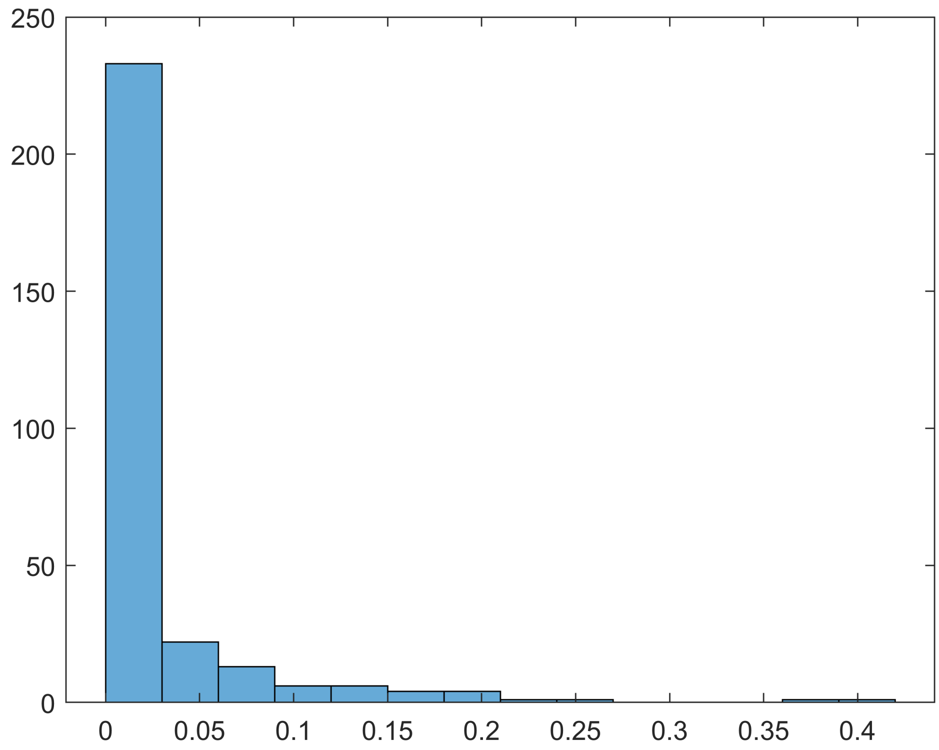
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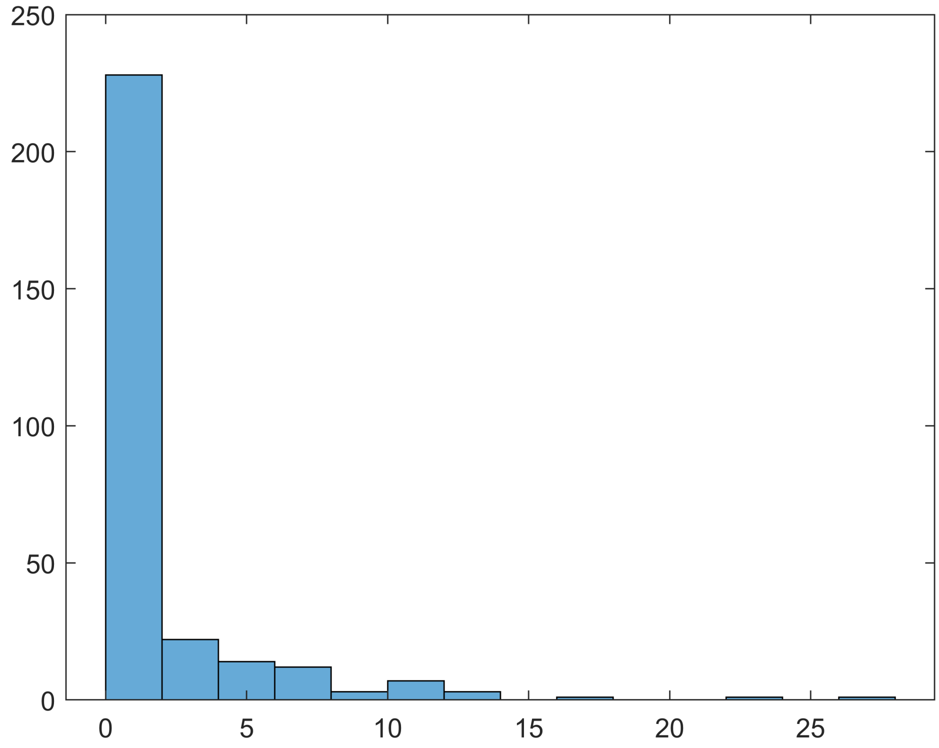
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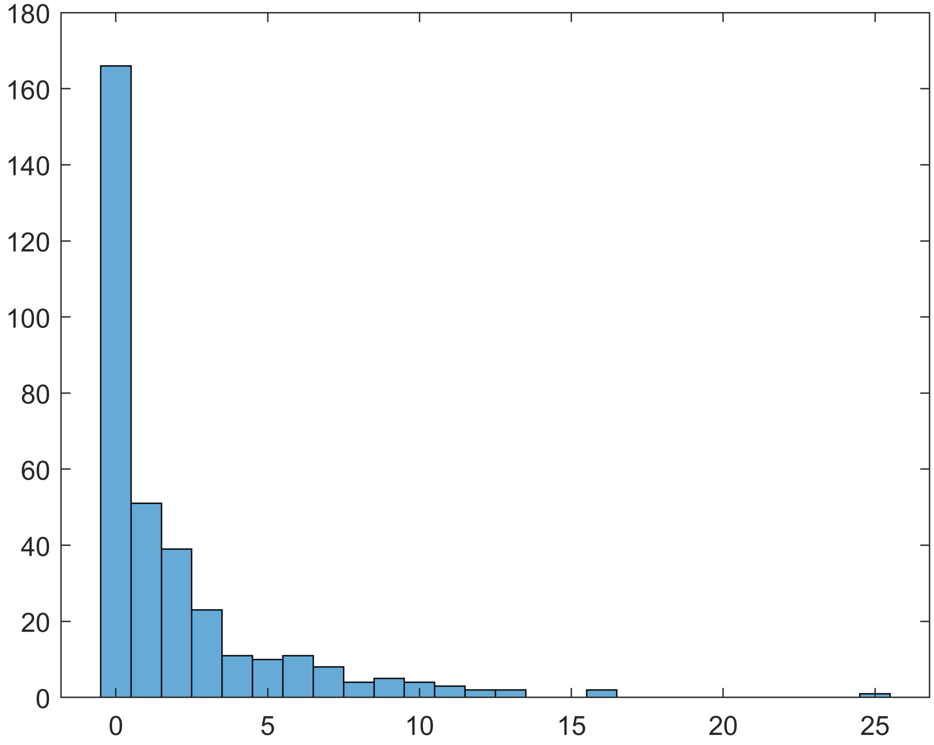
graph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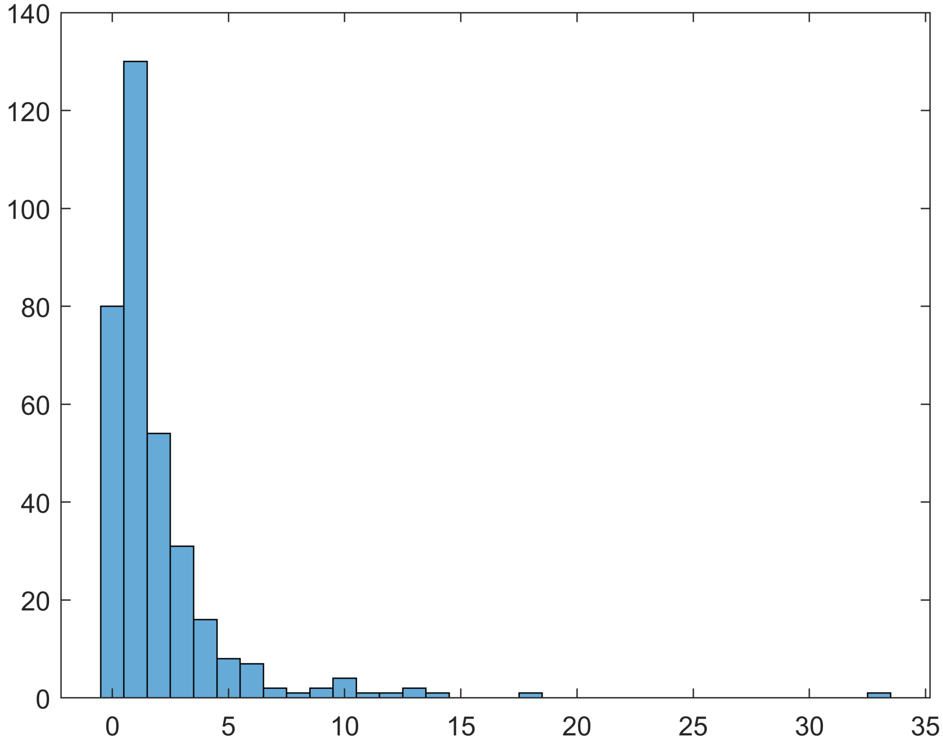
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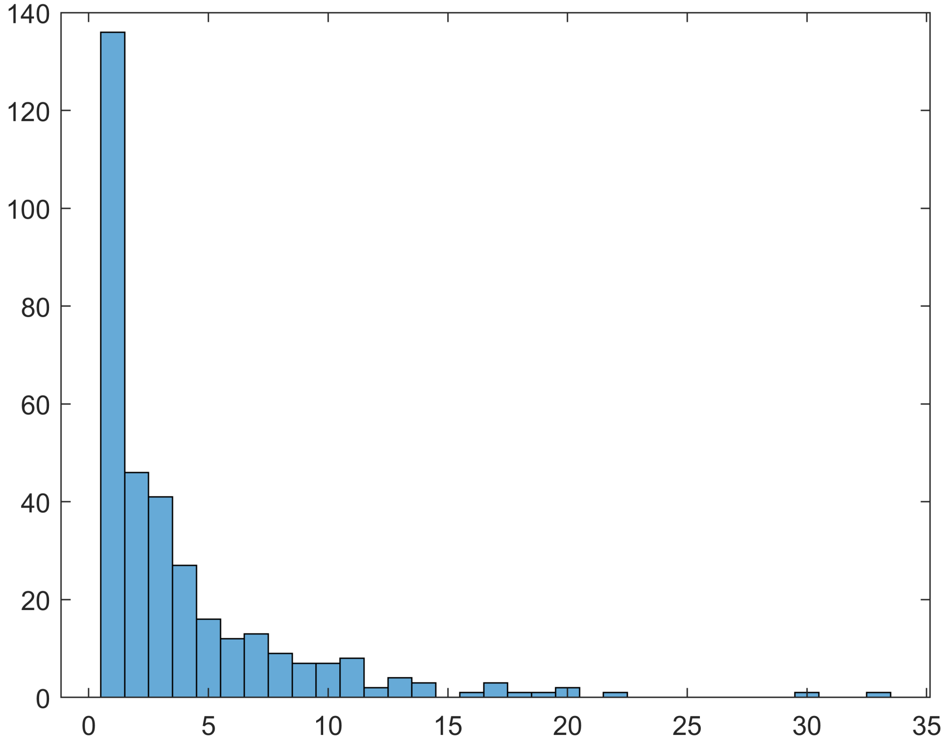
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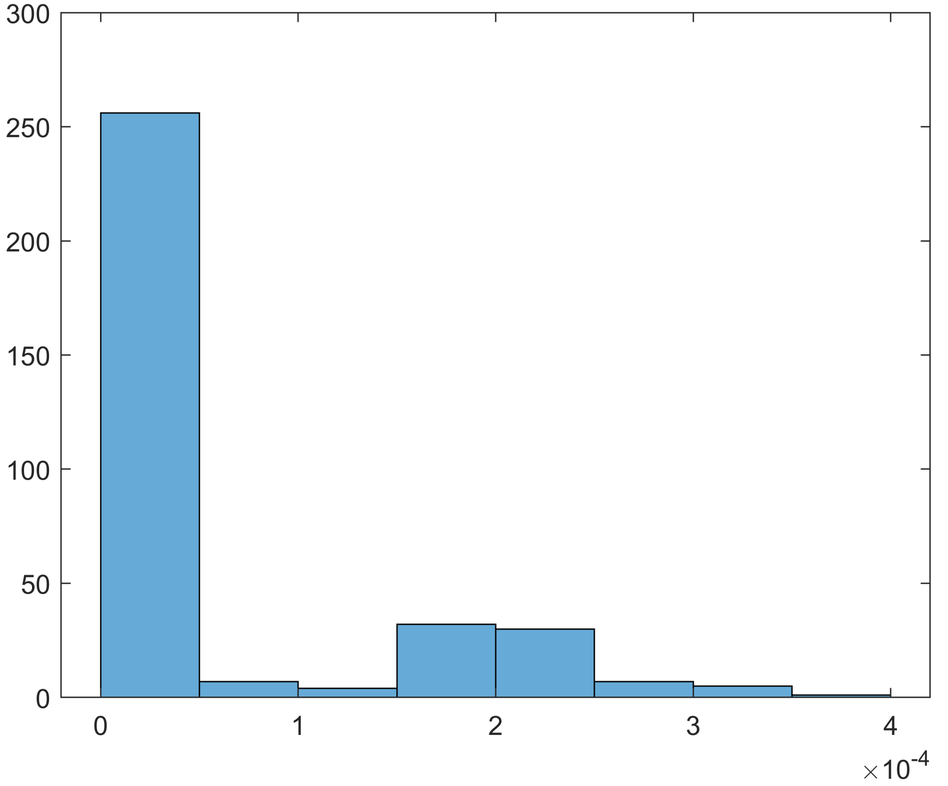
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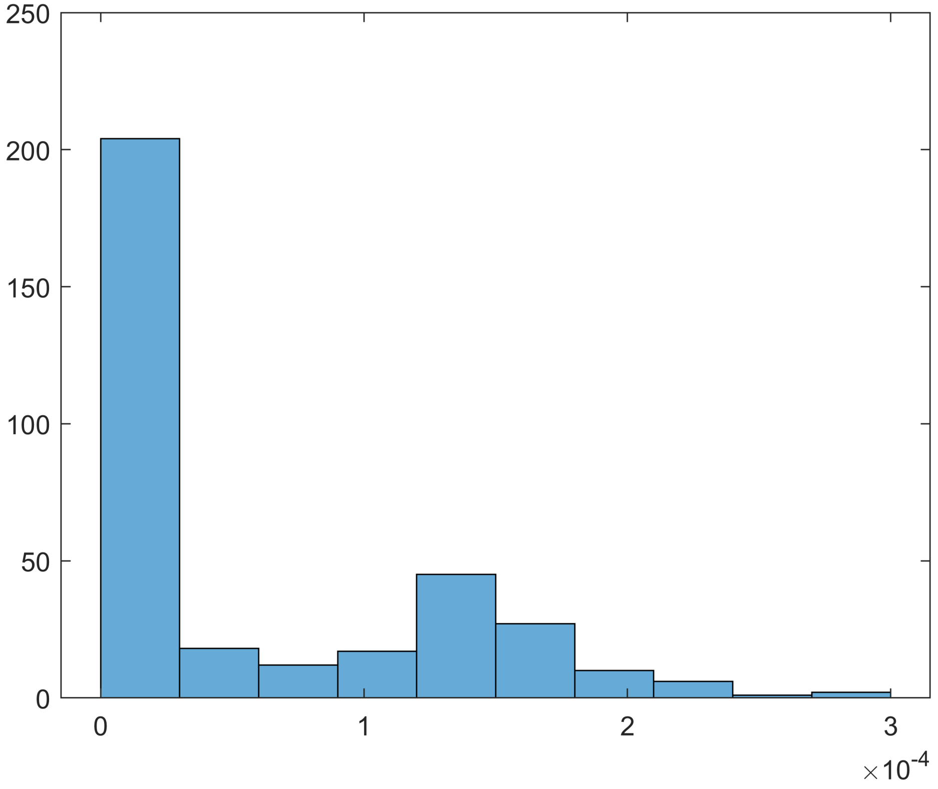
×10^-4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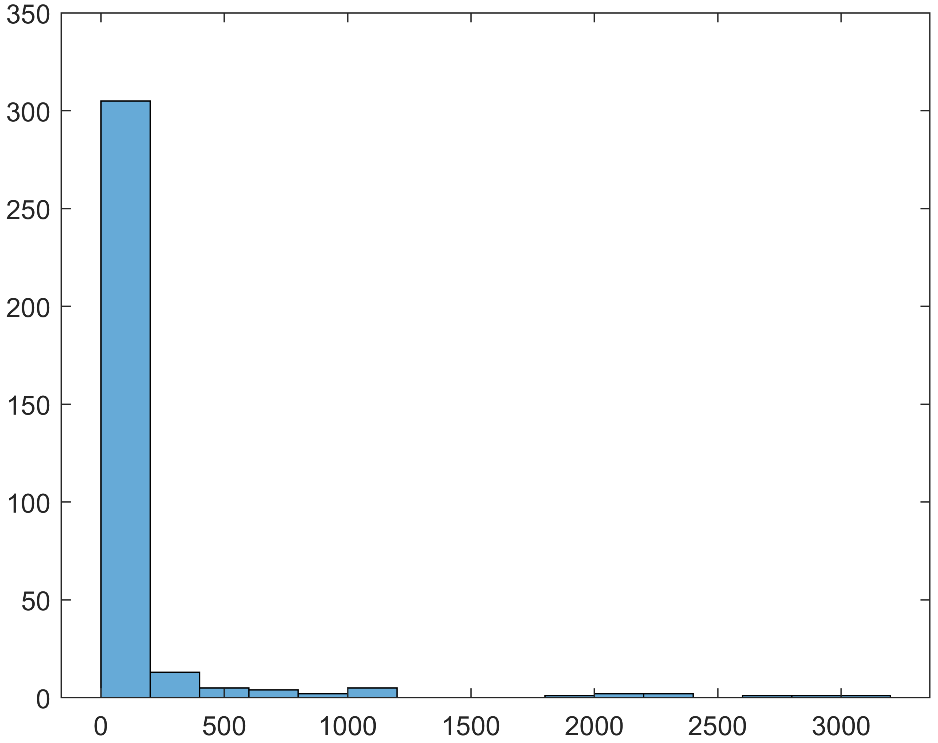
×10^-4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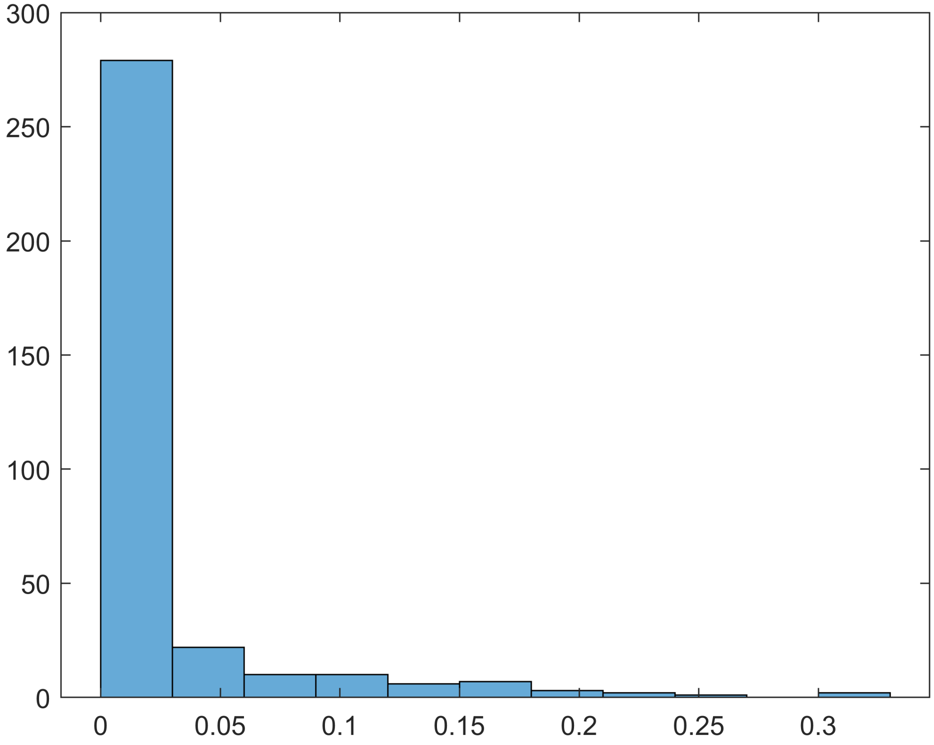
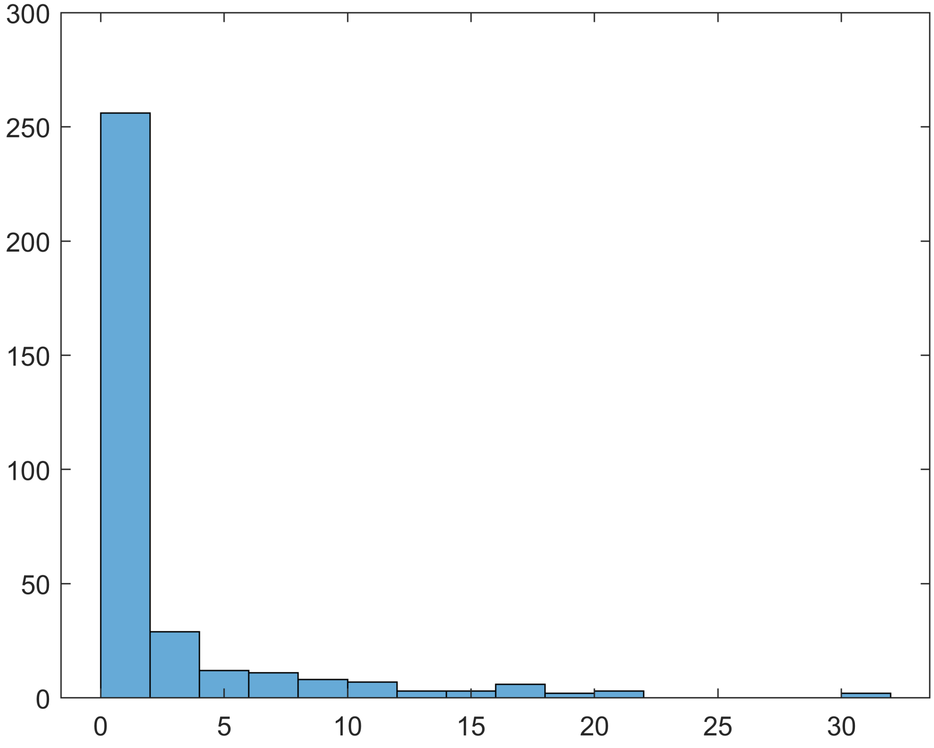
1500
2000
2500
3000





graph

5ο ερώτημα

```
TimeGraphs = {digraph};
NewGraphs ={digraph};

for i = 2:1:N-1
    TimeGraphs{end+1} = digraph;
    NewGraphs{end+1} = digraph;
end

for i = 1:1:N-1

    nodes = intersect(Graphs{i}.Nodes,Graphs{i+1}.Nodes);
    TimeGraphs{i} = addnode(TimeGraphs{i}, nodes);

     tem = table2cell(Graphs{i}.Edges);

     for j = 1:1:size(tem,1)
         if findnode(TimeGraphs{i},char(tem{j}(1))) ~= 0 && findnode(TimeGraphs{i},char(tem{j}(
             TimeGraphs{i} = addedge(TimeGraphs{i}, char(tem{j}(1)), char(tem{j}(2)));
         end
     end

     tem = table2cell(Graphs{i+1}.Edges);
     TempEdges = {};

     for j = 1:1:size(tem,1)
         if findnode(TimeGraphs{i},char(tem{j}(1))) ~= 0 && findnode(TimeGraphs{i},char(tem{j}(
             NewGraphs{i} = addedge(NewGraphs{i}, char(tem{j}(1)), char(tem{j}(2)));
         end
     end

end


numnodes(TimeGraphs{1})
```

```
ans = 150
```

```
numnodes(NewGraphs{1})
```

```
ans = 139
```

```
numedges(TimeGraphs{1})
```

```
ans = 421
```

```
numnodes(TimeGraphs{2})
```

```
ans = 180
```

```
numedges(TimeGraphs{2})
```

```
ans = 525
```

```
numnodes(TimeGraphs{3})
```

```
ans = 173
```

```
numedges(TimeGraphs{3})
```

```
ans = 309
```

6ο ερώτημα

```
Sgd={};
Scn={};
Sjc={};
Sa={};
Spa={};

for i = 1:1:N-1
    tempScn = zeros(numnodes(TimeGraphs{i}));
    tempSjc = tempScn;
    tempSa = tempScn;
    tempSpa = tempScn;

    Sgd{end+1} = distances(TimeGraphs{i});

    Sgd{end}(isinf(Sgd{end})|isnan(Sgd{end})) = 0;

    for j = 1:1:numnodes(TimeGraphs{i})

        neighbors1 = successors(TimeGraphs{i},char(TimeGraphs{i}.Nodes(j,1).(1)));

        for p = 1:1:numnodes(TimeGraphs{i})

            neighbors2 = successors(TimeGraphs{i},char(TimeGraphs{i}.Nodes(p,1).(1)));

            commonNeighbors = intersect(neighbors1,neighbors2);

            tempScn(j,p) = size(commonNeighbors,1);

            tempSjc(j,p) = size(commonNeighbors,1)/size(union(neighbors1,neighbors2),1);

            tempSpa(j,p) = size(neighbors1,1)*size(neighbors2,1);

            if size(commonNeighbors,1) > 0

                for rt = 1:1:size(commonNeighbors,2)
                    neighborDegree = size(successors(TimeGraphs{i},commonNeighbors{rt}),1);
                    tempSa = tempSa + (1/log(neighborDegree));
                end

            end

        end

    end
    Scn{end+1} = tempScn;

    Sjc{end+1} = tempSjc;

    Sa{end+1} = tempSa;

    Spa{end+1} = tempSpa;

end
```

7ο ερώτημα

```

for i = 1:1:N-1

    %Graph distance accuracy
    [~, sortIndex] = sort(Sgd{i}(:), 'descend');
    maxIndex = sortIndex(1:(numel(Sgd{i})*Pgd/100));
    counter = 0;
    for j = 1:1:size(maxIndex,1)
        [row,col] = ind2sub(size(Sgd{i}),maxIndex(j));
        try
            if findedge(NewGraphs{i},char(TimeGraphs{i}.Nodes(row,1).(1)),char(TimeGraphs{i}.No
            counter = counter + 1;
            end
        catch ME

        end

    end
    GraphDistanceAccuracy = counter/size(maxIndex,1)


    %Common neighbors accuracy
    [~, sortIndex] = sort(Scn{i}(:), 'descend');
    maxIndex = sortIndex(1:(numel(Scn{i})*Pcn/100));
    counter = 0;
    for j = 1:1:size(maxIndex,1)
        [row,col] = ind2sub(size(Scn{i}),maxIndex(j));
        try
            if findedge(NewGraphs{i},char(TimeGraphs{i}.Nodes(row,1).(1)),char(TimeGraphs{i}.No
            counter = counter + 1;
            end
        catch ME

        end

    end
    CommonNeighborsAccuracy = counter/size(maxIndex,1)


    %Jaccard’s Coefficient accuracy
    [~, sortIndex] = sort(Sjc{i}(:), 'descend');
    maxIndex = sortIndex(1:(numel(Sjc{i})*Pjc/100));
    counter = 0;
    for j = 1:1:size(maxIndex,1)
        [row,col] = ind2sub(size(Sjc{i}),maxIndex(j));
        try
            if findedge(NewGraphs{i},char(TimeGraphs{i}.Nodes(row,1).(1)),char(TimeGraphs{i}.No
            counter = counter + 1;
            end
        catch ME

        end

    end
    JaccardsCoefficientAccuracy = counter/size(maxIndex,1)



     %Adamic/adar accuracy
    [~, sortIndex] = sort(Sa{i}(:), 'descend');
    maxIndex = sortIndex(1:(numel(Sa{i})*Pa/100));
    counter = 0;
    for j = 1:1:size(maxIndex,1)
        [row,col] = ind2sub(size(Sa{i}),maxIndex(j));
        try
            if findedge(NewGraphs{i},char(TimeGraphs{i}.Nodes(row,1).(1)),char(TimeGraphs{i}.No
            counter = counter + 1;
            end
        catch ME

        end

    end
    AdamicAccuracy = counter/size(maxIndex,1)



    %Preferential Attachment accuracy
    [~, sortIndex] = sort(Spa{i}(:), 'descend');
    maxIndex = sortIndex(1:(numel(Spa{i})*Ppa/100));
    counter = 0;
    for j = 1:1:size(maxIndex,1)
        [row,col] = ind2sub(size(Spa{i}),maxIndex(j));
        try
            if findedge(NewGraphs{i},char(TimeGraphs{i}.Nodes(row,1).(1)),char(TimeGraphs{i}.No
            counter = counter + 1;
            end
        catch ME

        end

    end
    PreferentialAttachmentAccuracy = counter/size(maxIndex,1)
```

```
end
```

```
GraphDistanceAccuracy = 0.0080
CommonNeighborsAccuracy = 0.0284
JaccardsCoefficientAccuracy = 0.0053
AdamicAccuracy = 0.0062
PreferentialAttachmentAccuracy = 0.0373
GraphDistanceAccuracy = 0.0043
CommonNeighborsAccuracy = 0.0123
JaccardsCoefficientAccuracy = 6.1728e-04
AdamicAccuracy = 0.0062
PreferentialAttachmentAccuracy = 0.0210
Warning: Integer operands are required for colon operator when used as index.
GraphDistanceAccuracy = 0.0094
Warning: Integer operands are required for colon operator when used as index.
CommonNeighborsAccuracy = 0.0087
Warning: Integer operands are required for colon operator when used as index.
JaccardsCoefficientAccuracy = 0.0013
Warning: Integer operands are required for colon operator when used as index.
AdamicAccuracy = 0.0033
Warning: Integer operands are required for colon operator when used as index.
PreferentialAttachmentAccuracy = 0.0140
```