Precision(P20)

```
% Load data
load C:\Users\Andrea\Desktop\MAGISTRALE\Anno1-sem2\SearchEngines\HWS\seupd2021-goldr\RUN\RUN202

measure_prec20 = runtotonlyprec20(1:49,:);
measure_prec20 = table2array(measure_prec20)
```

```
measure_prec20 = 49×5
    0.4000    0.4000    0.4000    0.4500    0.4500
    0.2000    0.2000    0.2000    0.2000    0.2000
    0.2000    0.2000    0.2000    0.1500    0.1500
    0.3000    0.3000    0.3000    0.3500    0.3500
    0.2500    0.2500    0.2500    0.1000    0.1000
    0.3000    0.2500    0.3000    0.2000    0.2000
    0.3500    0.3500    0.3500    0.2500    0.3000
    0.2000    0.2000    0.2000    0.0500    0.0500
    0.3500    0.4000    0.3500    0.3500    0.3500
    0.2500    0.3500    0.2500    0.2500    0.2000
      .
      .
      .
```

```
% remove the now useless ap matrix
clear runtotonlyprec20;

% the significance level
alpha = 0.05;

% the mean for each run across the topics
m_avg_prec20 = mean(measure_prec20);



% sort in descending order of mean score
[~, idx] = sort(m_avg_prec20, 'descend');

ogmyruns = ""
```

```
ogmyruns =
""
```

```
ogmyruns(1) = "run1";
ogmyruns(2) = "run2";
ogmyruns(3) = "run3";
ogmyruns(4) = "run4";
ogmyruns(5) = "run5";

myruns_prec20 = ogmyruns
```

```
myruns_prec20 = 1×5 string
"run1"        "run2"        "run3"        "run4"        "run5"
```

```
% re-order runs by descending mean of the measure
measure_prec20 = measure_prec20(:, idx);
myruns_prec20 = myruns_prec20(:, idx);
```
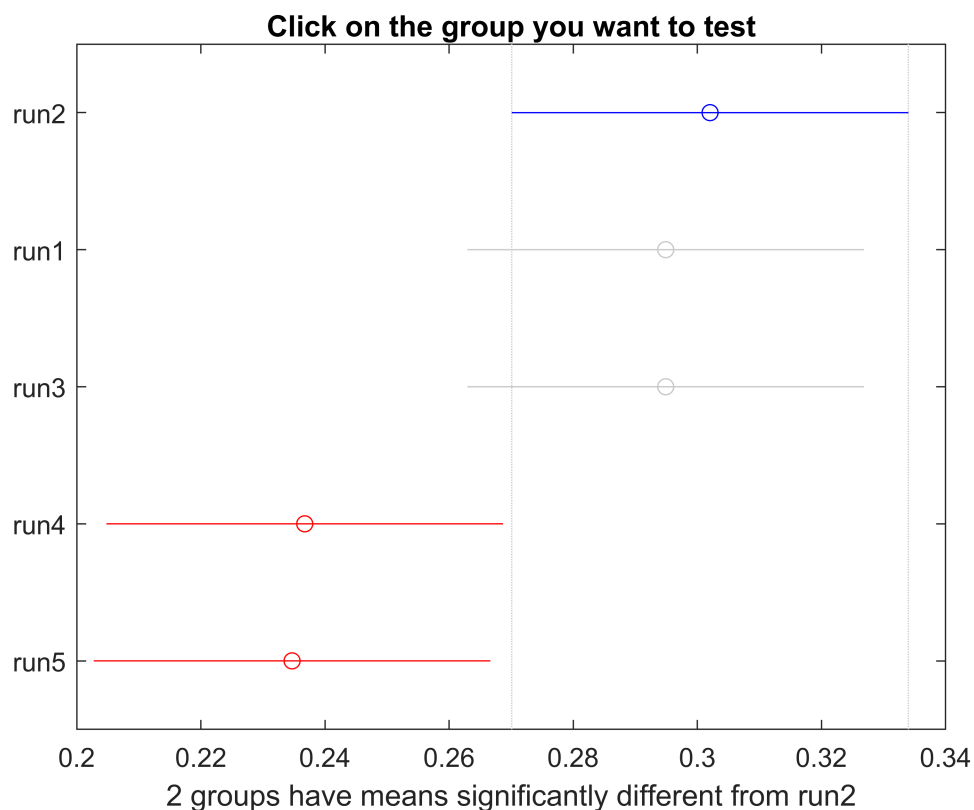
1

One way ANOVA

```
% perform the ANOVA
[~, tbl_prec20, sts_prec20] = anova1(measure_prec20, myruns_prec20, 'off');

% display the ANOVA table
tbl_prec20
```

tbl_prec20 = 4×6 cell

	1	2	3	4	5	6
1	'Source'	'SS'	'df'	'MS'	'F'	'Prob>F'
2	'Columns'	0.2246	4	0.0562	4.1764	0.0027
3	'Error'	3.2271	240	0.0134	[]	[]
4	'Total'	3.4518	244	[]	[]	[]

```
c = multcompare(sts_prec20, 'Alpha', alpha, 'Ctype', 'hsd');
```


Click on the group you want to test

2 groups have means significantly different from run2

```
c
```

c = 10×6

```
    1.0000    2.0000   -0.0568    0.0071    0.0710    0.9981
    1.0000    3.0000   -0.0568    0.0071    0.0710    0.9981
    1.0000    4.0000    0.0014    0.0653    0.1292    0.0423
    1.0000    5.0000    0.0034    0.0673    0.1313    0.0330
```

2

```
2.0000    3.0000    -0.0639         0    0.0639    1.0000
2.0000    4.0000    -0.0057    0.0582    0.1221    0.0945
2.0000    5.0000    -0.0037    0.0602    0.1241    0.0760
3.0000    4.0000    -0.0057    0.0582    0.1221    0.0945
3.0000    5.0000    -0.0037    0.0602    0.1241    0.0760
4.0000    5.0000    -0.0619    0.0020    0.0659    1.0000
```
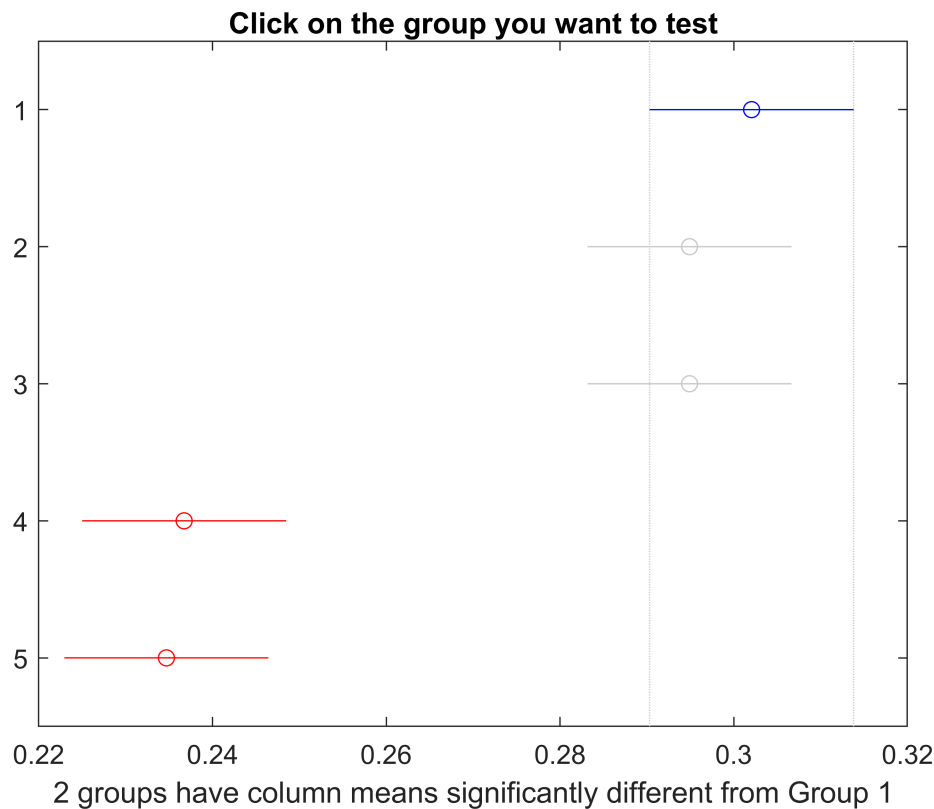
Two way ANOVA

```
% perform the ANOVA
[~, tbl2_prec20, sts2_prec20] = anova2(measure_prec20, 1,'off');

% display the ANOVA table
tbl2_prec20
```

tbl2_prec20 = 5×6 cell

	1	2	3	4	5	6
1	'Source'	'SS'	'df'	'MS'	'F'	'Prob>F'
2	'Columns'	0.2246	4	0.0562	30.9511	6.9140e-20
3	'Rows'	2.8788	48	0.0600	33.0545	2.5002e-70
4	'Error'	0.3484	192	0.0018	[]	[]
5	'Total'	3.4518	244	[]	[]	[]

```
c2 = multcompare(sts2_prec20, 'Alpha', alpha, 'Ctype', 'hsd');
```


Click on the group you want to test

2 groups have column means significantly different from Group 1

```
c2
```

```
c2 = 10×6
    1.0000    2.0000   -0.0163    0.0071    0.0306    0.9214
    1.0000    3.0000   -0.0163    0.0071    0.0306    0.9214
    1.0000    4.0000    0.0418    0.0653    0.0888    0.0000
    1.0000    5.0000    0.0439    0.0673    0.0908    0.0000
    2.0000    3.0000   -0.0235         0    0.0235    1.0000
    2.0000    4.0000    0.0347    0.0582    0.0816    0.0000
    2.0000    5.0000    0.0367    0.0602    0.0837    0.0000
    3.0000    4.0000    0.0347    0.0582    0.0816    0.0000
    3.0000    5.0000    0.0367    0.0602    0.0837    0.0000
    4.0000    5.0000   -0.0214    0.0020    0.0255    0.9993
```

BoxPlot

```matlab
% Compute the mean performance of each run across topics

m_prec20 = mean(measure_prec20);
myruns3 = ogmyruns;

% sort in descending order of mean score
[~, idx] = sort(m_prec20, 'descend');

% re-order runs by descending mean of the measure
% needed to have a more nice looking box plot
measure_prec20 = measure_prec20(:, idx);
myruns3 = myruns_prec20(:,idx);

figure

% show the box plot
boxchart(measure_prec20)

%hold on

% plot the mean on top of the box plot
%plot (m, ':x', "MarkerSize", 10, "LineWidth", 2)

% adjust tick labels on x-axis, y-axis range, and font size
ax = gca;
ax.FontSize = 14;
ax.XTickLabel = myruns3;

xlabel("Runs (decreasing order of mean performance)")
ylabel("Performance")
```
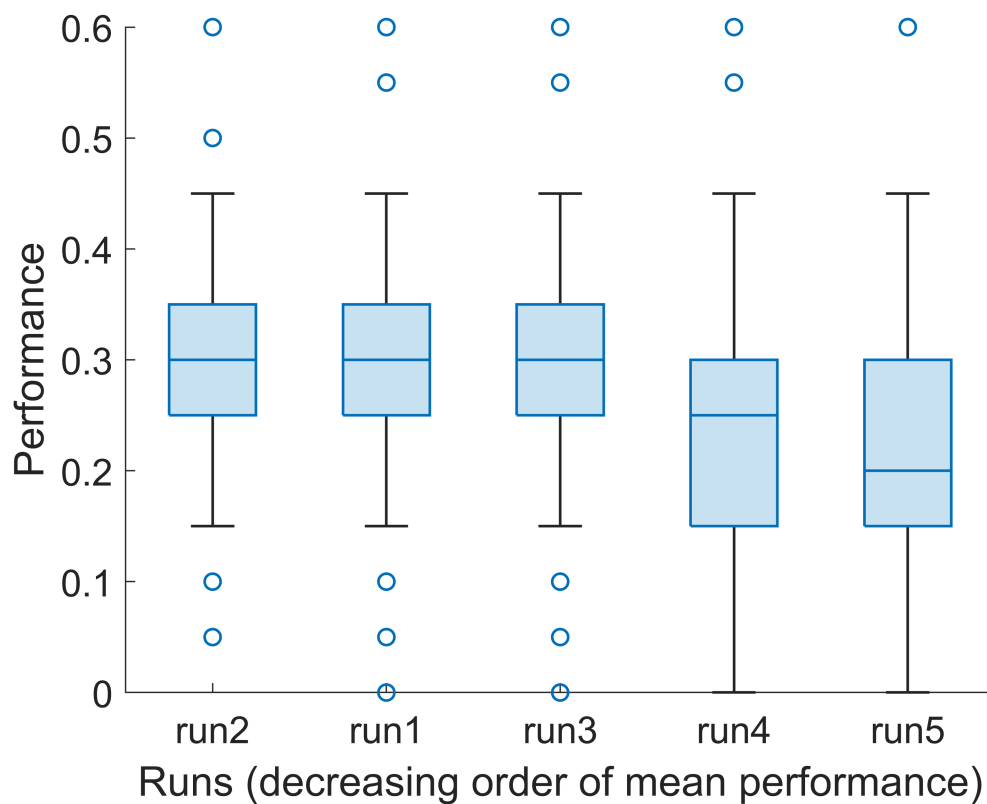
Performance

Runs (decreasing order of mean performance)

```
newmeasure_p = measure_prec20(:, [2,1,3,4,5]);
for r1 = 1:length(myruns3)
    for r2 = 1:length(myruns3)
        if r1 < r2
            %tstudnet comparisons
            [~, p] = ttest(newmeasure_p(:, r1), newmeasure_p(:, r2));
            fprintf("Run %s vs %s: p-value %f", ogmyruns(r1), ogmyruns(r2), p)
            df = length(newmeasure_p) - 1;
            tCrit = tinv(1 - 0.05/2, df);
            tRuns = tinv(1 - p/2, df);

            % t distribution
            ar = -5:.01:5;
            ts = tpdf(ar, df);

            % find where we are above and below tCrit
            idx1 = ar >= tCrit;
            idx2 = ar <= -tCrit;

            figure

            plot(ar, ts, "LineWidth", 1.5, "Color", "k");

            hold on

            % plot two vertical lines corresponding to tCrit
            h(1) = plot([tCrit tCrit], get(gca, "ylim"), "Color", "r", "LineWidth", 2, "LineSty
```

```matlab
            plot([-tCrit -tCrit], get(gca, "ylim"), "Color", "r", "LineWidth", 2, "LineStyle",

            % color the area under the t distribution above and below tCrit
            area(ar(idx1), ts(idx1) , "FaceColor", "r", "FaceAlpha", 0.3, "EdgeColor", "none");
            area(ar(idx2), ts(idx2), "FaceColor", "r", "FaceAlpha", 0.3, "EdgeColor", "none");

            h(2) = plot([tRuns tRuns], get(gca, "ylim"), "Color", "g", "LineWidth", 2, "LineSty
            plot([-tRuns -tRuns], get(gca, "ylim"), "Color", "g", "LineWidth", 2, "LineStyle",
            %xline(tRuns, "Color", "g", "LineWidth", 2);

            ax = gca;
            ax.FontSize = 13;
            title(['Run ',num2str(r1),'  vs  Run ',num2str(r2)])

            lgnd = legend([h(1), h(2)], ["$t_{crit}$", "$t_{stat}$"], "Interpreter", "Latex");
            lgnd.FontSize = 15;

            %fprintf("%d - %d \n", r1, r2)
            if r2 == 5
                break
            end
        end
    end
end
```
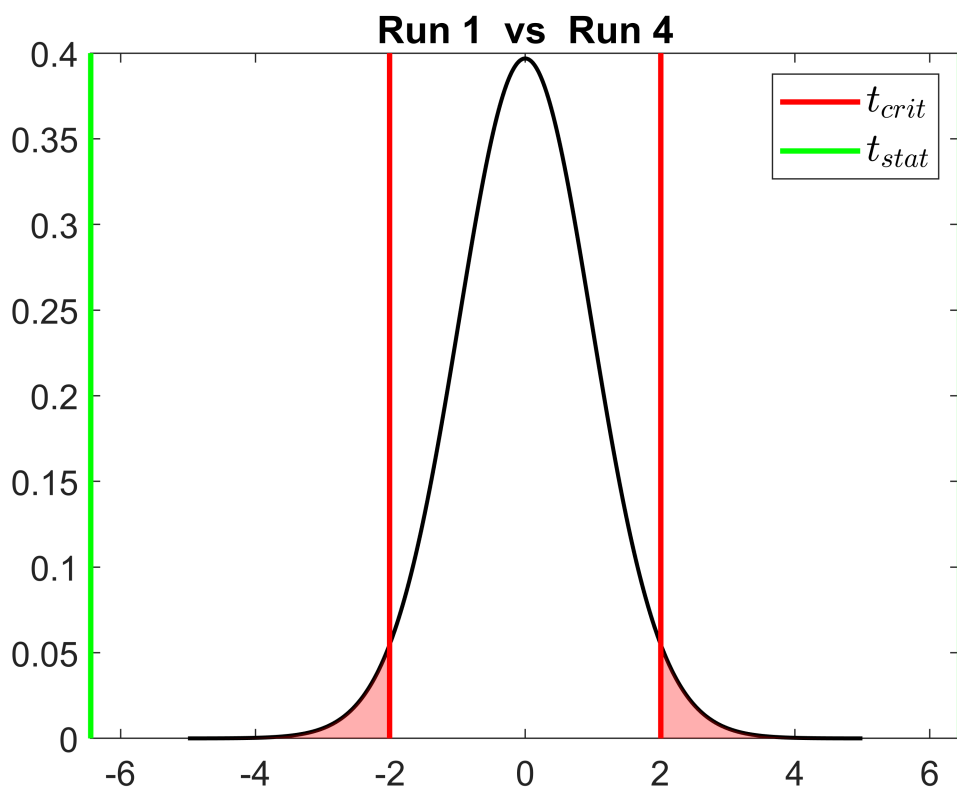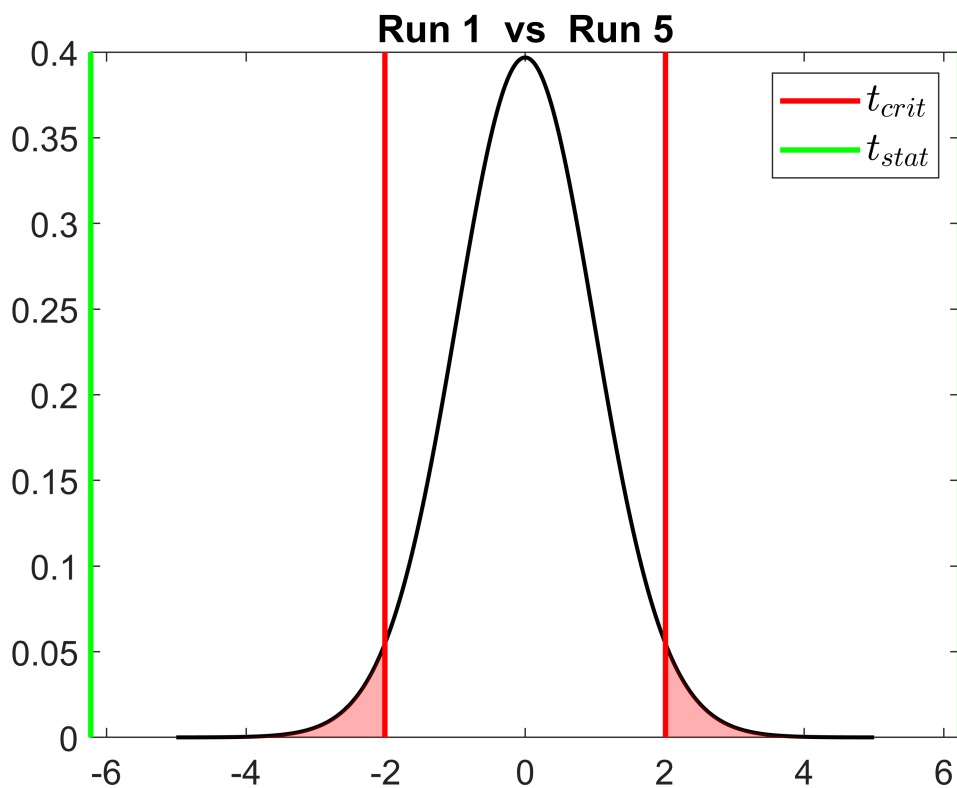
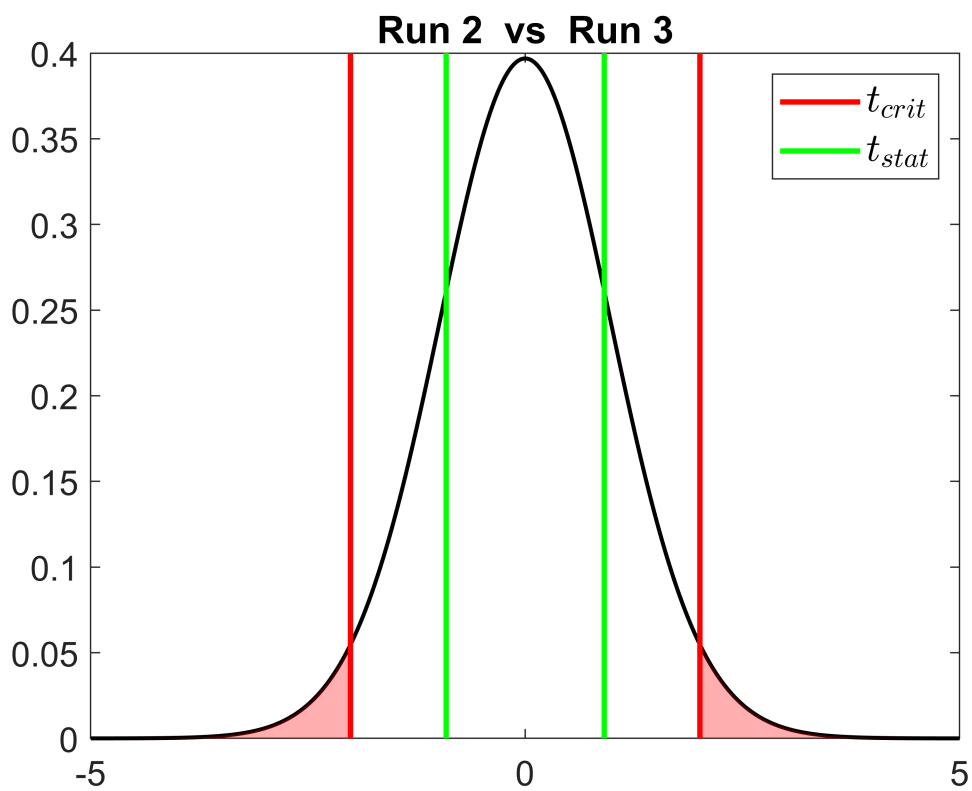Run run1 vs run2: p-value 0.367517
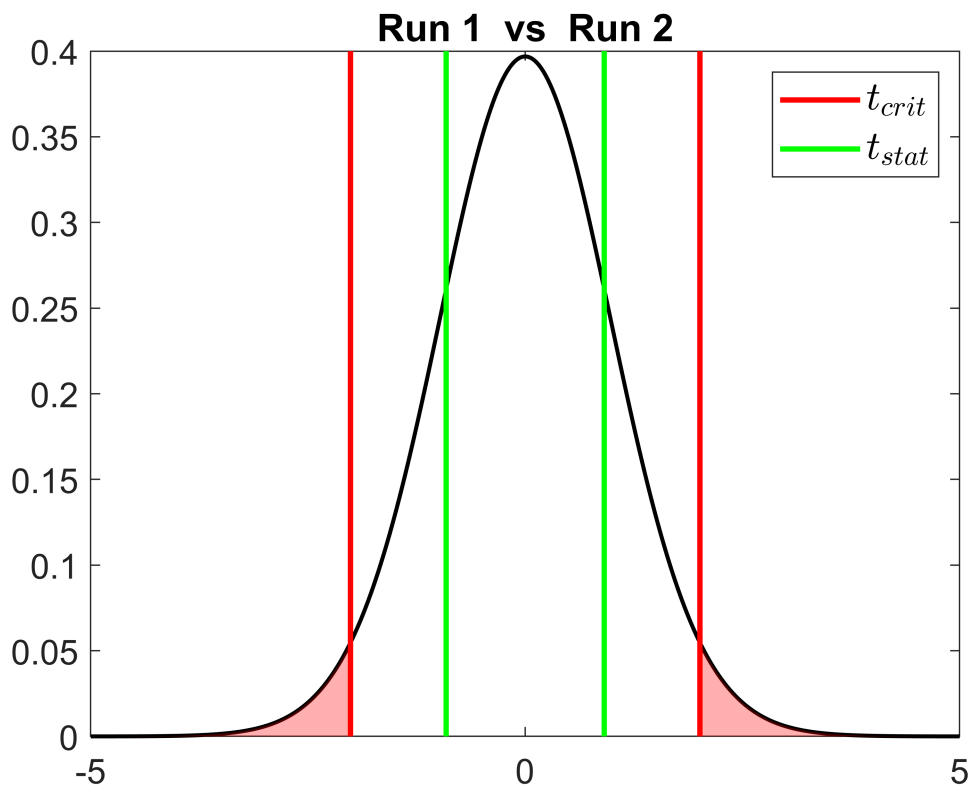
Run run1 vs run3: p-value NaN
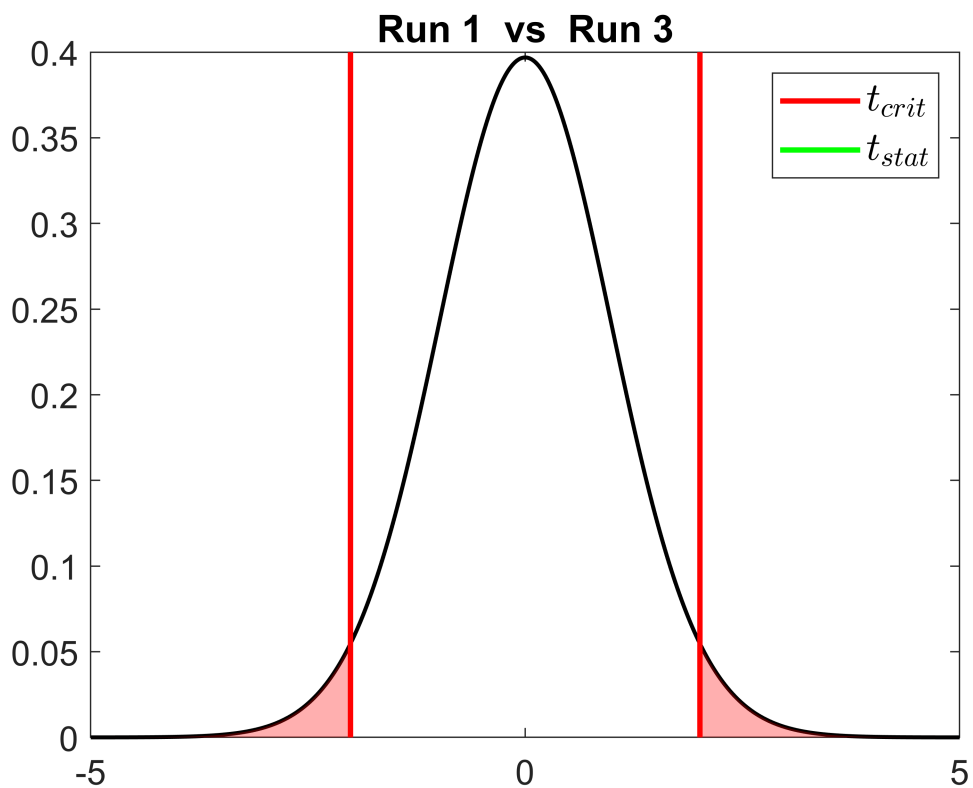
Run 1 vs Run 3

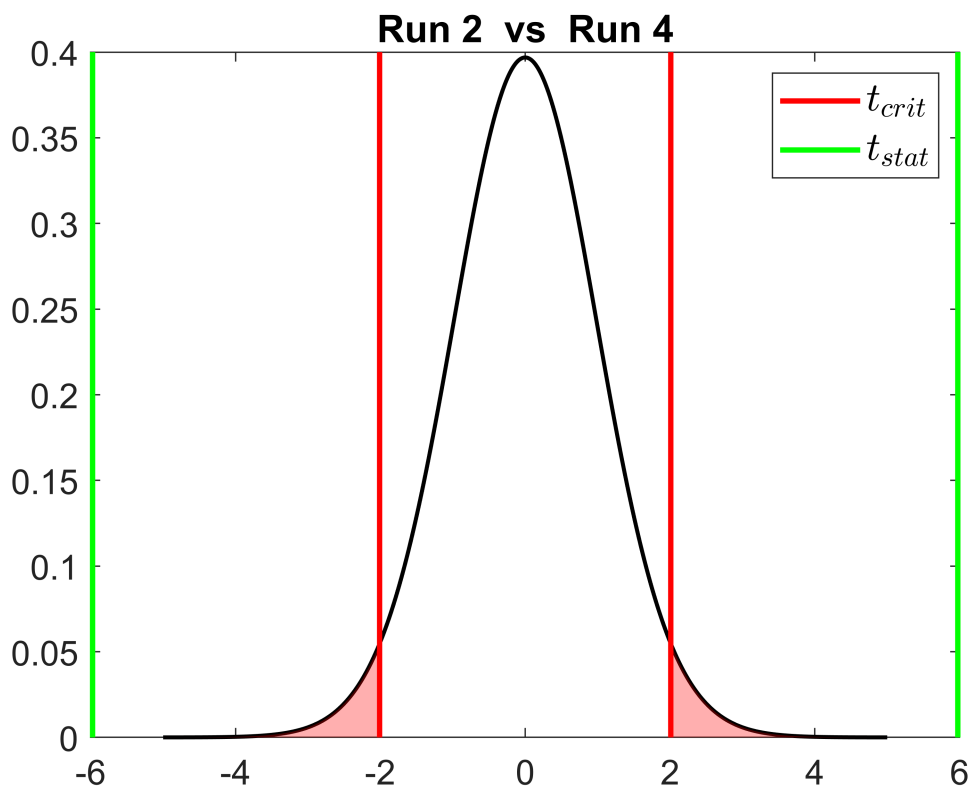Run run1 vs run4: p-value 0.000000

Run 1 vs Run 4

Run run1 vs run5: p-value 0.000000
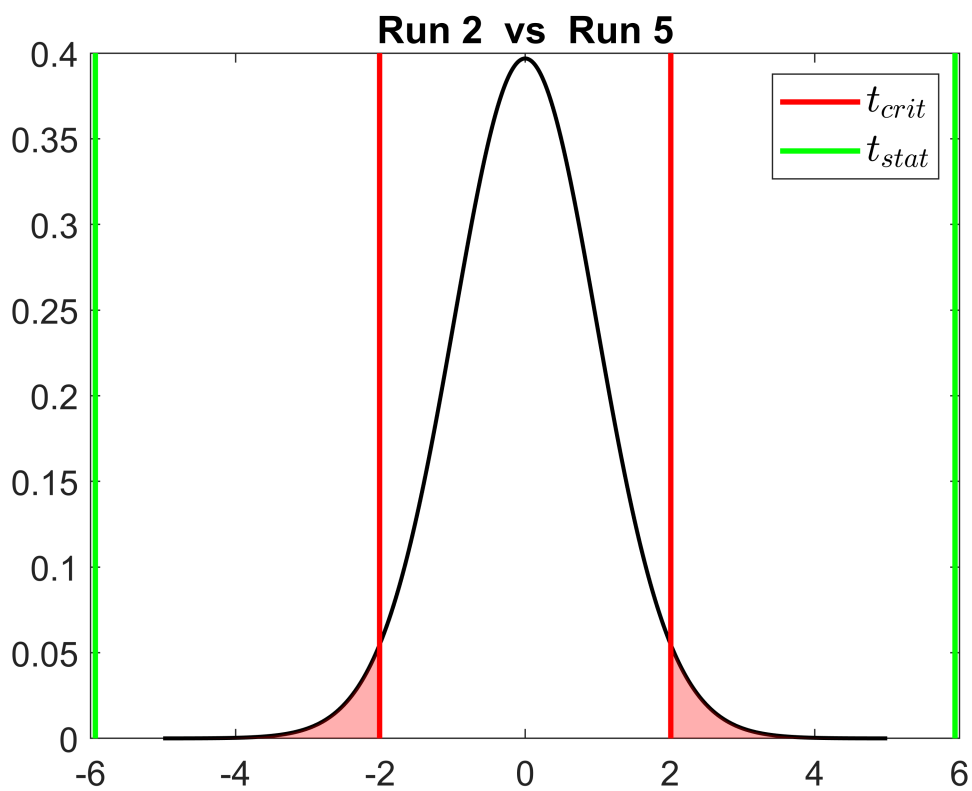
Run run2 vs run3: p-value 0.367517

Run run2 vs run4: p-value 0.000000

Run 2 vs Run 4

Run run2 vs run5: p-value 0.000000

Run 2 vs Run 5

Run run3 vs run4: p-value 0.000000
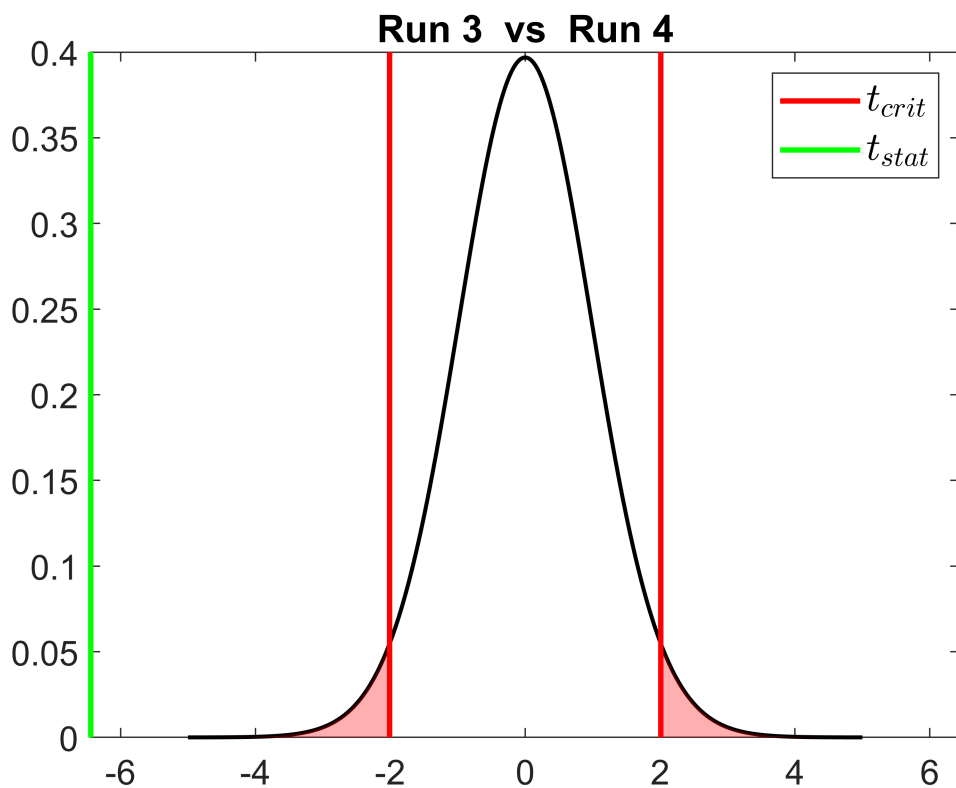
Run 3 vs Run 4

Run run3 vs run5: p-value 0.000000

Run 3 vs Run 5
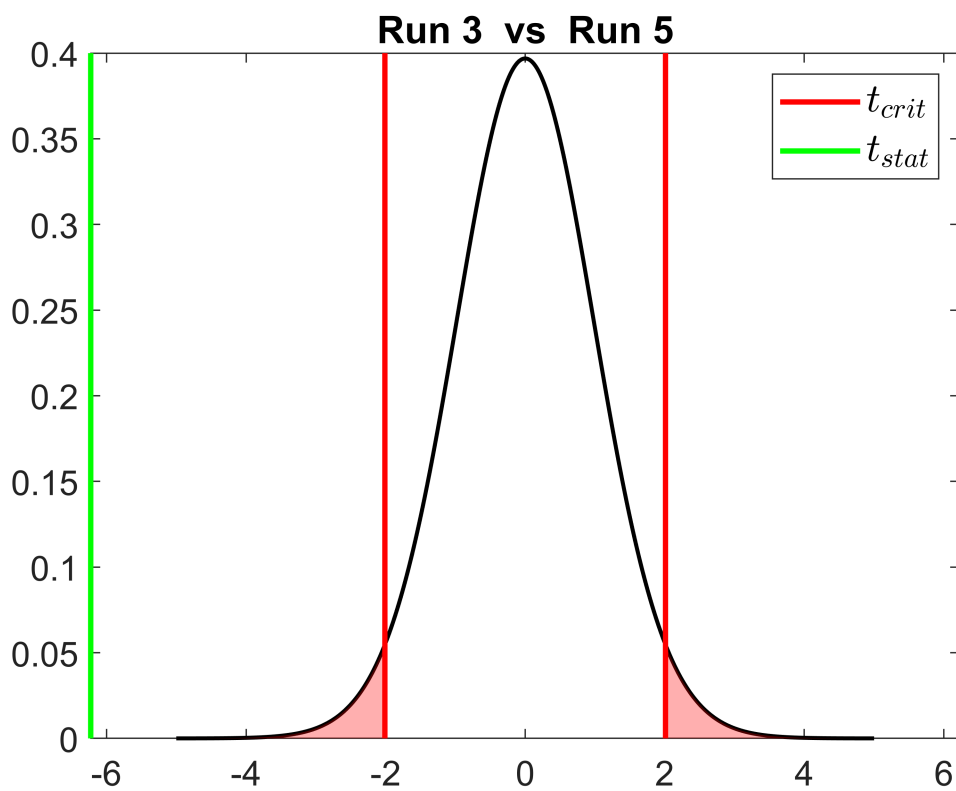
Run run4 vs run5: p-value 0.642165

Run 4 vs Run 5