

## Pval combination report, version 2

**Summary:** For  $G = 2$ , min has highest power. For  $G = 3$ , there's no clear winner. For  $G = 5$ , min+Fisher has highest power.

**Step 1:** Run Normal and NB sims for  $G = 2$ . Here we will have two sets of ovals, one for KS, one for WS. Combine them using 1) min 2) harmonic mean 3) Fisher 4) CCT. Obtain final p-value from permutation. The combination method selected from this method will be used in Step 2 in conjunction with all p-value selection methods. The following powers were estimated from

### For 2 group NORMAL OUTCOME

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	hmp	min	Fisher	CCT
[1,]	0	0.046	0.052	0.036	0.048	0.036	0.054	0.054	0.046	0.052	0.052
[2,]	1	0.236	0.232	0.030	0.258	0.296	0.258	0.274	0.282	0.272	0.270
[3,]	2	0.456	0.456	0.016	0.528	0.620	0.548	0.610	0.614	0.612	0.604
[4,]	3	0.612	0.602	0.010	0.652	0.806	0.764	0.806	0.804	0.798	0.804
[5,]	4	0.724	0.718	0.004	0.794	0.918	0.868	0.910	0.918	0.902	0.906
[6,]	5	0.812	0.816	0.002	0.858	0.960	0.950	0.966	0.966	0.966	0.964

### For 2 group NB outcome

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	hmp	min	Fisher	CCT
[1,]	0.0	0.044	0.044	0.032	0.046	0.038	0.046	0.044	0.048	0.044	0.044
[2,]	0.5	0.042	0.038	0.034	0.036	0.046	0.044	0.040	0.046	0.036	0.038
[3,]	1.0	0.066	0.072	0.052	0.070	0.082	0.068	0.076	0.084	0.074	0.074
[4,]	1.5	0.168	0.174	0.046	0.184	0.184	0.170	0.180	0.182	0.180	0.180
[5,]	2.0	0.196	0.198	0.018	0.234	0.264	0.228	0.258	0.250	0.260	0.256
[6,]	2.5	0.276	0.270	0.046	0.342	0.412	0.366	0.398	0.404	0.400	0.392
[7,]	3.0	0.356	0.358	0.032	0.446	0.622	0.588	0.610	0.612	0.604	0.602
[8,]	3.5	0.466	0.466	0.038	0.584	0.782	0.774	0.800	0.808	0.798	0.800
[9,]	4.0	0.626	0.630	0.064	0.712	0.938	0.934	0.938	0.942	0.940	0.938
[10,]	4.5	0.706	0.706	0.088	0.816	0.976	0.980	0.984	0.988	0.982	0.982
[11,]	5.0	0.804	0.810	0.086	0.890	0.998	0.996	0.998	1.000	0.998	0.998

Min appears to have best power in both cases, so we're choosing it as our p-value combination technique in the first step, i.e, combining WS and KS.

**Step 2:** When  $G > 2$ , we will have GC2 columns of statistics from the first step. In this step we will combine them with Fisher, HMP and CCT, then obtain final p-value from permutation

### NORMAL OUTCOME

1. Normal,  $G = 3$ , all groups are different, unbalanced design

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	min+min	min+hmp	min+Fisher	min+CCT
[1,]	0	0.046	0.052	0.056	0.040	0.042	0.052	0.056	0.054	0.058	0.054
[2,]	1	0.170	0.176	0.050	0.234	0.268	0.202	0.264	0.258	0.266	0.258
[3,]	2	0.346	0.360	0.058	0.464	0.682	0.458	0.650	0.640	0.622	0.634
[4,]	3	0.502	0.502	0.028	0.642	0.890	0.636	0.872	0.870	0.836	0.874
[5,]	4	0.674	0.686	0.044	0.792	0.970	0.844	0.964	0.964	0.962	0.964
[6,]	5	0.756	0.772	0.036	0.850	0.992	0.924	0.992	0.992	0.990	0.992

## 2. Normal, G=3, all groups different, balanced design

```
> pow
```

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	min+min	min+hmp	min+Fisher	min+CCT
[1,]	0	0.044	0.046	0.050	0.050	0.062	0.058	0.066	0.068	0.072	0.066
[2,]	1	0.144	0.154	0.054	0.202	0.302	0.210	0.290	0.296	0.306	0.298
[3,]	2	0.296	0.302	0.052	0.412	0.698	0.418	0.664	0.666	0.662	0.664
[4,]	3	0.482	0.502	0.048	0.650	0.944	0.690	0.912	0.916	0.932	0.918
[5,]	4	0.598	0.636	0.074	0.758	0.990	0.832	0.974	0.978	0.980	0.978
[6,]	5	0.710	0.744	0.062	0.838	0.998	0.916	0.996	0.996	0.996	0.996

## 3. Normal, G = 5, unbalanced design. 3 groups are same, the other two different

```
> pow
```

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	min+min	min+hmp	min+Fisher	min+CCT
[1,]	0	0.042	0.046	0.036	0.042	0.066	0.058	0.082	0.066	0.056	0.062
[2,]	1	0.120	0.116	0.040	0.168	0.210	0.166	0.206	0.208	0.230	0.208
[3,]	2	0.262	0.262	0.034	0.382	0.536	0.360	0.490	0.516	0.576	0.506
[4,]	3	0.420	0.434	0.044	0.544	0.732	0.542	0.696	0.724	0.792	0.716
[5,]	4	0.602	0.610	0.032	0.736	0.914	0.732	0.880	0.908	0.946	0.900
[6,]	5	0.682	0.696	0.022	0.802	0.962	0.824	0.964	0.972	0.988	0.968

## 4. Normal, G = 5, balanced design, 3 groups are same, the other two different

```
> pow
```

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	min+min	min+hmp	min+Fisher	min+CCT
[1,]	0	0.044	0.056	0.058	0.048	0.072	0.066	0.072	0.064	0.068	0.062
[2,]	1	0.172	0.172	0.068	0.238	0.304	0.202	0.288	0.292	0.342	0.290
[3,]	2	0.362	0.358	0.048	0.504	0.758	0.520	0.702	0.724	0.808	0.714
[4,]	3	0.550	0.568	0.056	0.740	0.950	0.800	0.924	0.948	0.980	0.936
[5,]	4	0.672	0.682	0.064	0.796	0.982	0.880	0.984	0.994	0.998	0.984
[6,]	5	0.796	0.810	0.052	0.888	0.978	0.922	0.998	1.000	1.000	0.992

## NEGATIVE BINOMIAL OUTCOME

### 1. G=3, all different, unbalanced.

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	min+min	min+hmp	min+Fisher	min+CCT
[1,]	0.0	0.038	0.042	0.050	0.040	0.040	0.036	0.040	0.038	0.040	0.038
[2,]	0.5	0.042	0.044	0.030	0.046	0.052	0.046	0.050	0.048	0.046	0.044
[3,]	1.0	0.040	0.042	0.048	0.042	0.054	0.042	0.050	0.054	0.054	0.052
[4,]	1.5	0.066	0.068	0.060	0.074	0.096	0.066	0.094	0.090	0.074	0.088
[5,]	2.0	0.104	0.104	0.072	0.126	0.144	0.114	0.146	0.140	0.140	0.140
[6,]	2.5	0.144	0.144	0.054	0.192	0.322	0.160	0.290	0.270	0.258	0.262
[7,]	3.0	0.268	0.266	0.102	0.356	0.542	0.356	0.516	0.508	0.462	0.502
[8,]	3.5	0.344	0.344	0.114	0.440	0.742	0.494	0.730	0.708	0.658	0.712
[9,]	4.0	0.472	0.472	0.168	0.624	0.916	0.724	0.898	0.884	0.858	0.884
[10,]	4.5	0.590	0.590	0.246	0.710	0.978	0.852	0.972	0.974	0.954	0.974
[11,]	5.0	0.724	0.732	0.352	0.826	1.000	0.966	1.000	0.998	0.994	0.998

## 2. G = 3, all different, balanced

```
> pow_nb
```

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	min+min	min+hmp	min+Fisher	min+CCT
[1,]	0.0	0.044	0.048	0.044	0.046	0.052	0.048	0.054	0.056	0.056	0.050
[2,]	0.5	0.050	0.050	0.042	0.046	0.064	0.054	0.064	0.058	0.066	0.058
[3,]	1.0	0.068	0.070	0.056	0.074	0.090	0.076	0.084	0.080	0.082	0.076
[4,]	1.5	0.092	0.106	0.048	0.104	0.104	0.108	0.110	0.106	0.108	0.110
[5,]	2.0	0.128	0.116	0.054	0.144	0.174	0.142	0.164	0.164	0.178	0.164
[6,]	2.5	0.168	0.180	0.062	0.210	0.314	0.216	0.290	0.294	0.322	0.292
[7,]	3.0	0.246	0.244	0.058	0.326	0.532	0.342	0.466	0.476	0.512	0.478
[8,]	3.5	0.358	0.358	0.090	0.450	0.724	0.546	0.686	0.686	0.708	0.688
[9,]	4.0	0.444	0.440	0.098	0.552	0.894	0.736	0.854	0.854	0.876	0.860
[10,]	4.5	0.560	0.554	0.190	0.668	0.968	0.850	0.954	0.950	0.960	0.954
[11,]	5.0	0.704	0.706	0.220	0.812	0.988	0.930	0.982	0.984	0.982	0.982

## 3. G = 5, unbalanced, 3 groups are same, the other is different.

```
> pow_nb
```

	theta	GO	GO-perm	PERMANOVA	BETADISPER	KS.original	WS.original	min+min	min+hmp	min+Fisher	min+CCT
[1,]	0.0	0.022	0.032	0.040	0.026	0.052	0.040	0.056	0.054	0.048	0.052
[2,]	0.5	0.024	0.036	0.042	0.030	0.034	0.032	0.042	0.036	0.032	0.034
[3,]	1.0	0.038	0.054	0.038	0.046	0.062	0.062	0.072	0.066	0.068	0.062
[4,]	1.5	0.080	0.090	0.066	0.100	0.090	0.102	0.112	0.106	0.104	0.104
[5,]	2.0	0.122	0.130	0.044	0.148	0.136	0.136	0.170	0.160	0.172	0.152
[6,]	2.5	0.188	0.192	0.050	0.218	0.220	0.220	0.228	0.242	0.262	0.238
[7,]	3.0	0.264	0.268	0.048	0.306	0.342	0.330	0.350	0.366	0.410	0.352
[8,]	3.5	0.364	0.370	0.066	0.442	0.554	0.480	0.546	0.572	0.638	0.558
[9,]	4.0	0.434	0.438	0.064	0.508	0.688	0.598	0.672	0.698	0.756	0.692
[10,]	4.5	0.564	0.566	0.082	0.682	0.838	0.742	0.830	0.844	0.882	0.840
[11,]	5.0	0.676	0.672	0.102	0.762	0.922	0.842	0.920	0.942	0.950	0.928