

## Supplementary Material

Supplementary Table 1: Performance of WBS, FPOP and SMUCE in our speed simulations with 50 replications. Khat : Proportion of true K recovery, MSE : average mean square error, exactTP and FP (average number of exactly recovered and false breakpoint), BkpE : average breakpointError (see R package)

### WBS\_1

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 0.52 | 2.60E-2 | 4.40    | 7.15    | 1.12 |
| WBS.bic    | 0.54 | 2.58E-2 | 4.41    | 7.16    | 1.11 |
| WBS.mbic   | 0.41 | 2.73E-2 | 4.35    | 6.99    | 1.23 |
| Fpop.3     | 0.20 | 2.89E-2 | 4.33    | 6.65    | 1.45 |
| Fpop.2     | 0.57 | 2.44E-2 | 4.50    | 7.10    | 1.06 |
| Fpop.1     | 0.05 | 4.45E-2 | 4.52    | 12.56   | 5.92 |
| Smuce.0.55 | 0.02 | 3.65E-2 | 4.01    | 6.64    | 1.94 |
| Smuce.0.45 | 0.01 | 4.03E-2 | 3.87    | 6.63    | 2.13 |
| Smuce.0.35 | 0.01 | 4.26E-2 | 3.82    | 6.55    | 2.26 |

### WBS\_2

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 0.95 | 4.12E-2 | 4.10    | 2.93    | 0.27 |
| WBS.bic    | 0.96 | 4.09E-2 | 4.11    | 2.94    | 0.27 |
| WBS.mbic   | 0.95 | 4.29E-2 | 4.07    | 2.89    | 0.29 |
| Fpop.3     | 0.87 | 4.71E-2 | 4.06    | 2.70    | 0.44 |
| Fpop.2     | 0.94 | 3.81E-2 | 4.20    | 2.84    | 0.30 |
| Fpop.1     | 0.14 | 9.21E-2 | 4.18    | 6.58    | 3.97 |
| Smuce.0.55 | 0.76 | 5.71E-2 | 3.90    | 2.93    | 0.62 |
| Smuce.0.45 | 0.70 | 6.30E-2 | 3.80    | 2.94    | 0.70 |
| Smuce.0.35 | 0.64 | 6.81E-2 | 3.70    | 2.95    | 0.78 |

### WBS\_2'(sigma as in Smuce)

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 0.96 | 3.38E-2 | 4.90    | 2.15    | 0.12 |
| WBS.bic    | 0.95 | 3.35E-2 | 4.91    | 2.14    | 0.12 |
| WBS.mbic   | 0.97 | 3.29E-2 | 4.91    | 2.12    | 0.09 |
| Fpop.3     | 0.99 | 2.97E-2 | 5.00    | 2.01    | 0.08 |
| Fpop.2     | 0.95 | 3.07E-2 | 5.00    | 2.06    | 0.12 |
| Fpop.1     | 0.15 | 8.21E-2 | 4.97    | 5.59    | 3.63 |
| Smuce.0.55 | 0.95 | 3.00E-2 | 5.00    | 2.05    | 0.12 |
| Smuce.0.45 | 0.97 | 2.98E-2 | 5.00    | 2.03    | 0.10 |
| Smuce.0.35 | 0.98 | 2.97E-2 | 5.00    | 2.02    | 0.09 |

## Supplementary Material

### WBS\_3

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 0.29 | 9.66E-2 | 7.30    | 5.59    | 1.94 |
| WBS.bic    | 0.32 | 9.67E-2 | 7.27    | 5.70    | 1.89 |
| WBS.mbic   | 0.15 | 1.04E-1 | 7.20    | 5.07    | 2.34 |
| Fpop.3     | 0.06 | 1.19E-1 | 7.02    | 4.56    | 2.92 |
| Fpop.2     | 0.32 | 9.65E-2 | 7.32    | 5.56    | 1.97 |
| Fpop.1     | 0.09 | 1.32E-1 | 7.43    | 9.84    | 4.57 |
| Smuce.0.55 | 0.08 | 1.15E-1 | 6.95    | 5.51    | 2.42 |
| Smuce.0.45 | 0.05 | 1.25E-1 | 6.86    | 5.40    | 2.66 |
| Smuce.0.35 | 0.02 | 1.36E-1 | 6.76    | 5.25    | 2.93 |

### WBS\_4

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 0.74 | 3.70E-1 | 9.21    | 4.44    | 1.84 |
| WBS.bic    | 0.75 | 3.58E-1 | 9.33    | 4.46    | 1.75 |
| WBS.mbic   | 0.43 | 8.69E-1 | 5.43    | 2.93    | 6.43 |
| Fpop.3     | 0.18 | 9.24E-1 | 5.27    | 2.73    | 6.59 |
| Fpop.2     | 0.62 | 4.24E-1 | 8.93    | 4.03    | 2.20 |
| Fpop.1     | 0.38 | 3.56E-1 | 9.60    | 5.79    | 2.54 |
| Smuce.0.55 | 0.02 | 1.19E+0 | 3.15    | 5.47    | 7.86 |
| Smuce.0.45 | 0.01 | 1.23E+0 | 2.84    | 5.26    | 8.25 |
| Smuce.0.35 | 0.01 | 1.29E+0 | 2.39    | 5.10    | 8.84 |

### WBS\_5

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 0.59 | 2.60E-1 | 12.19   | 3.35    | 1.02 |
| WBS.bic    | 0.58 | 2.61E-1 | 12.19   | 3.37    | 1.05 |
| WBS.mbic   | 0.62 | 2.62E-1 | 12.15   | 3.32    | 0.98 |
| Fpop.3     | 0.94 | 2.29E-1 | 12.47   | 2.48    | 0.44 |
| Fpop.2     | 0.95 | 2.15E-1 | 12.52   | 2.53    | 0.44 |
| Fpop.1     | 0.39 | 2.63E-1 | 12.50   | 3.79    | 1.66 |
| Smuce.0.55 | 0.15 | 1.17E+0 | 8.43    | 4.58    | 4.02 |
| Smuce.0.45 | 0.10 | 1.33E+0 | 7.80    | 4.85    | 4.54 |
| Smuce.0.35 | 0.07 | 1.45E+0 | 7.44    | 4.90    | 4.89 |

## Supplementary Material

**Supplementary Table 2 :** Performance of WBS, FPOP and SMUCE in our speed simulations with 50 replications. Khat : Proportion of true K recovery, MSE : average mean square error, exactTP and FP : average number of exactly recovered breakpoint, BkpE : average breakpointError (see R package)

n= 200000, Bkp= 10

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 1.00 | 1.57E-4 | 5.70    | 4.30    | 0.00 |
| WBS.bic    | 1.00 | 1.60E-4 | 5.66    | 4.34    | 0.00 |
| WBS.mbic   | 1.00 | 1.61E-4 | 5.64    | 4.36    | 0.00 |
| Fpop.3     | 1.00 | 1.56E-4 | 5.64    | 4.36    | 0.00 |
| Fpop.2     | 1.00 | 1.56E-4 | 5.64    | 4.36    | 0.00 |
| Fpop.1     | 0.00 | 6.55E-4 | 5.66    | 11.88   | 7.54 |
| Smuce.0.55 | 0.86 | 1.58E-4 | 5.64    | 4.50    | 0.14 |
| Smuce.0.45 | 0.94 | 1.56E-4 | 5.64    | 4.42    | 0.06 |
| Smuce.0.35 | 0.96 | 1.56E-4 | 5.64    | 4.40    | 0.04 |

n= 200000, Bkp= 50

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 0.54 | 1.06E-3 | 30.36   | 19.60   | 1.45 |
| WBS.bic    | 0.56 | 1.09E-3 | 30.28   | 19.34   | 1.12 |
| WBS.mbic   | 0.46 | 1.12E-3 | 30.08   | 19.48   | 1.29 |
| Fpop.3     | 0.72 | 8.79E-4 | 31.58   | 17.86   | 0.62 |
| Fpop.2     | 0.84 | 8.45E-4 | 31.76   | 17.92   | 0.39 |
| Fpop.1     | 0.00 | 1.43E-3 | 31.80   | 26.80   | 8.97 |
| Smuce.0.55 | 0.68 | 8.80E-4 | 31.58   | 18.06   | 0.65 |
| Smuce.0.45 | 0.70 | 8.80E-4 | 31.58   | 18.04   | 0.62 |
| Smuce.0.35 | 0.72 | 8.80E-4 | 31.58   | 18.02   | 0.59 |

n= 200000, Bkp= 100

|            | Khat | MSE     | exactTP | exactFP | BkpE |
|------------|------|---------|---------|---------|------|
| WBS.ssic   | 0.14 | 2.89E-3 | 57.44   | 41.08   | 5.18 |
| WBS.bic    | 0.16 | 2.92E-3 | 57.22   | 41.78   | 5.82 |
| WBS.mbic   | 0.14 | 2.92E-3 | 57.88   | 40.70   | 5.37 |
| Fpop.3     | 0.38 | 1.87E-3 | 61.76   | 36.44   | 2.06 |
| Fpop.2     | 0.58 | 1.78E-3 | 62.22   | 36.70   | 1.38 |
| Fpop.1     | 0.04 | 2.32E-3 | 62.44   | 45.50   | 9.58 |
| Smuce.0.55 | 0.36 | 1.89E-3 | 61.70   | 36.92   | 2.01 |
| Smuce.0.45 | 0.36 | 1.91E-3 | 61.60   | 36.96   | 2.13 |
| Smuce.0.35 | 0.36 | 1.91E-3 | 61.60   | 36.96   | 2.11 |

# Supplementary Material

n= 200000, Bkp= 500

|            | Khat | MSE     | exactTP | exactFP | BkpE  |
|------------|------|---------|---------|---------|-------|
| WBS.ssic   | 0.00 | 1.73E-2 | 264.94  | 230.38  | 84.81 |
| WBS.bic    | 0.04 | 1.73E-2 | 265.20  | 229.88  | 83.55 |
| WBS.mbic   | 0.02 | 1.78E-2 | 261.92  | 228.96  | 82.51 |
| Fpop.3     | 0.00 | 1.18E-2 | 292.64  | 166.12  | 45.15 |
| Fpop.2     | 0.00 | 1.00E-2 | 301.14  | 171.12  | 32.35 |
| Fpop.1     | 0.08 | 9.85E-3 | 310.52  | 190.86  | 32.02 |
| Smuce.0.55 | 0.00 | 1.38E-2 | 286.34  | 176.30  | 48.17 |
| Smuce.0.45 | 0.00 | 1.42E-2 | 284.78  | 176.42  | 49.90 |
| Smuce.0.35 | 0.00 | 1.47E-2 | 283.12  | 176.26  | 51.83 |

n= 200000, Bkp= 1000

|            | Khat | MSE     | exactTP | exactFP | BkpE   |
|------------|------|---------|---------|---------|--------|
| WBS.ssic   | 0.00 | 3.56E-2 | 498.14  | 448.14  | 211.32 |
| WBS.bic    | 0.00 | 3.55E-2 | 499.12  | 450.16  | 213.70 |
| WBS.mbic   | 0.00 | 3.67E-2 | 495.04  | 441.60  | 207.83 |
| Fpop.3     | 0.00 | 2.97E-2 | 537.54  | 300.38  | 172.82 |
| Fpop.2     | 0.00 | 2.22E-2 | 572.26  | 320.98  | 120.18 |
| Fpop.1     | 0.00 | 1.94E-2 | 605.82  | 363.10  | 86.42  |
| Smuce.0.55 | 0.00 | 3.98E-2 | 502.74  | 338.88  | 196.30 |
| Smuce.0.45 | 0.00 | 4.16E-2 | 497.04  | 338.76  | 202.65 |
| Smuce.0.35 | 0.00 | 4.43E-2 | 490.00  | 337.82  | 211.98 |