SDAIZA User's Guide

1. Description

The program computes **analytically** the expected value and the sampling distribution function of the adverse impact (AI) ratio for single-stage, top-down, finite sample selections using a predictor with known effect size **when only the total number of applicants and the proportion of minority applicants in the total applicant population is given**.

2. Assumptional Basis and Method

The calculations are based on the assumption that the predictor has a normal distribution with the same variance but a different mean value in the two applicant populations. In particular, and without loss of generalization, it is understood that the predictor has a standard normal distribution in the minority applicant population. De Corte and Lievens (2005) details the method used to derive the sampling distribution function of the AI ratio.

3. Technical Aspects

The present program is limited to applications where the total number of applicants is at most 2,000 and the number of required new employees does not exceed 500. The latter application requires about 10,000 CPU seconds on a 850 MHz machine.

To execute the program, a PC running under MS-Windows 95, 98, NT, XP or 2000 is required.

4. Input

Observe that all input is in free format: Variables or vectors that have a name commencing with the letters I, J, K, L, M, N get INTEGER values. All other variables and vectors get FLOATING POINT values.

- # 1: **NSUB, NREQ, DIP, PA** with
  - **NSUB**: the total number of applicants
  - **NREQ**: the number of required new employees
  - **DIP**: effect size predictor (composite). Minority group is base.
  - **PA**: Proportion of **majority** applicants in the total applicant population

5. Sample Input File

Important: in preparing the input file, use a simple text editor such as Notepad, Wordpad or any other standard ASCII producing editor. DO NOT USE TEXT PROCESSING PROGRAMS SUCH AS MS-WORD or WORDPERFECT. Also, when saving

the input file in Notepad, use the option "All Files" in the "Save as type" box. When saving in Wordpad, use the "Text Document-MS-DOS Format" option in the "Save as type" box, and be **aware that Wordpad has the nasty habit of adding the extension .txt to the file name that you specify**. Thus, with Wordpad, if you specify the name of the input file as "MINPUT", the file will in fact be saved as "MINPUT.TXT"; and this is the name that you have to use in the command to run the present programs. Here is a sample input file, for the `sdaiza` program.

```
50  6  .55 .80
```

6. Running the Program

Suppose you copied the executable source of the program to the `d:ssel` directory on your machine. In that case, the input file must also be saved in the `d:ssel` directory. Next, to run the program, you have to open an MS-DOS Command window. The way to do this varies from one operating system (i.e., Windows 95, 98, NT a.s.o.) to the other, and you should use your local "HELP" button when in doubt about this feature.

In the MS-DOS Command window you type `d:`, followed by RETURN or ENTER, and your computer will return the `D:\>` command prompt. Next, you type `cd ssel` after the `D:\>` command prompt, again followed by RETURN or ENTER, and your computer will respond with the `D:\ssel>` command prompt. Now, you can execute the program by typing `sdaiza < minput > moutput` where "minput" is the name of the input file and "moutput" is the name of the output file. At the end of the execution, the PC will return the command prompt `D:\ssel>`. You can then inspect the output by editing the output file with either Notepad, Wordpad or any other simple editor program.

7. Sample Output

```
++++++++++++
++ SDAIZA ++
++++++++++++

Analytical computation of the expected value and the
sampling distribution function of the adverse impact ratio
for single-stage selection decisions when only the total
number of candidates and the proportion of minority
applicants in the total applicant population is given.

Program written by Wilfried De Corte, Ghent University Belgium

The program uses routines from the Slatec library (see
```

http://www.geocities.com/Athens/Olympus/5564) and a couple
of algorithms from StatLib (see http://lib.stat.cmu.edu/apstat/)

PROBLEM SPECIFICATION

Total number of applicants: 50
Required number of new employees: 6
Effect size predictor (composite): 0.550000
Proportion of minority applicants in applicant population: 0.800

PROGRAM OUTPUT

Exact Sampling Distribution Function Adverse Impact (AI).
The value 999999.9 for AI means AI is not defined
N: number of AI ratio value in the sorted list
VAI: value of the AI ratio
PVAI: probability of the AI ratio value
(PVAI values printed as 0.0e+0 are actually very
small and certainly less than .1e-09)
CPVAI: cumulative probability AI ratio value

N	VAI	PVAI	CPVAI
1	0.00000	0.58332E+00	0.583321376052
2	0.02222	0.00000E+00	0.583321376052
3	0.02727	0.00000E+00	0.583321376052
4	0.03256	0.00000E+00	0.583321376052
5	0.03810	0.00000E+00	0.583321376052
6	0.04348	0.00000E+00	0.583321376052
7	0.04390	0.00000E+00	0.583321376052
8	0.05000	0.00000E+00	0.583321376052
9	0.05556	0.00000E+00	0.583321376052
10	0.05641	0.00000E+00	0.583321376052
11	0.06316	0.00000E+00	0.583321376052
12	0.06383	0.00000E+00	0.583321376052
13	0.06818	0.00000E+00	0.583321376052
14	0.07027	0.00000E+00	0.583321376052
15	0.07778	0.00000E+00	0.583321376052
16	0.08140	0.00000E+00	0.583321376052

17	0.08333	0.00000E+00	0.583321376052
18	0.08571	0.00000E+00	0.583321376052
19	0.08696	0.00000E+00	0.583321376052
20	0.09412	0.00000E+00	0.583321376052
21	0.09524	0.00000E+00	0.583321376052
22	0.10204	0.00000E+00	0.583321376052
23	0.10303	0.00000E+00	0.583321376052
24	0.10976	0.00000E+00	0.583321376052
25	0.11111	0.00000E+00	0.583321376052
26	0.11250	0.00000E+00	0.583321376052
27	0.12258	0.00000E+00	0.583321376052
28	0.12500	0.00000E+00	0.583321376052
29	0.12766	0.00000E+00	0.583321376052
30	0.13333	0.12080E-09	0.583321376173
31	0.13636	0.00000E+00	0.583321376173
32	0.14103	0.00000E+00	0.583321376173
33	0.14483	0.77583E-09	0.583321376949
34	0.15714	0.45352E-08	0.583321381484
35	0.15789	0.00000E+00	0.583321381484
36	0.16279	0.00000E+00	0.583321381484
37	0.17037	0.24182E-07	0.583321405666
38	0.17391	0.00000E+00	0.583321405666
39	0.17568	0.00000E+00	0.583321405666
40	0.18462	0.11781E-06	0.583321523472
41	0.19048	0.00000E+00	0.583321523472
42	0.19444	0.00000E+00	0.583321523472
43	0.20000	0.52503E-06	0.583322048507
44	0.20833	0.00000E+00	0.583322048507
45	0.21429	0.00000E+00	0.583322048507
46	0.21667	0.21425E-05	0.583324191027
47	0.21951	0.00000E+00	0.583324191027
48	0.22222	0.00000E+00	0.583324191027
49	0.23478	0.80094E-05	0.583332200405
50	0.23529	0.00000E+00	0.583332200405
51	0.25000	0.00000E+00	0.583332200405
52	0.25455	0.27433E-04	0.583359633430
53	0.25758	0.00000E+00	0.583359633430
54	0.27273	0.00000E+00	0.583359633430

55	0.27619	0.86072E-04	0.583445705294
56	0.28125	0.00000E+00	0.583445705294
57	0.28205	0.00000E+00	0.583445705294
58	0.30000	0.24724E-03	0.583692945066
59	0.30645	0.00000E+00	0.583692945066
60	0.31579	0.00000E+00	0.583692945066
61	0.31915	0.00000E+00	0.583692945066
62	0.32558	0.00000E+00	0.583692945066
63	0.32632	0.64959E-03	0.584342539037
64	0.33333	0.19812E-09	0.584342539235
65	0.35135	0.00000E+00	0.584342539235
66	0.35556	0.15590E-02	0.585901586189
67	0.36207	0.11530E-08	0.585901587342
68	0.38095	0.00000E+00	0.585901587342
69	0.38824	0.34120E-02	0.589313616227
70	0.38889	0.00000E+00	0.589313616227
71	0.39286	0.61209E-08	0.589313622348
72	0.42500	0.67942E-02	0.596107860430
73	0.42593	0.29690E-07	0.596107890120
74	0.42857	0.00000E+00	0.596107890120
75	0.43478	0.00000E+00	0.596107890120
76	0.43902	0.00000E+00	0.596107890120
77	0.46154	0.13175E-06	0.596108021871
78	0.46667	0.12276E-01	0.608383823690
79	0.47059	0.00000E+00	0.608383823690
80	0.50000	0.53536E-06	0.608384359045
81	0.51429	0.20058E-01	0.628441920788
82	0.51515	0.00000E+00	0.628441920788
83	0.54167	0.19929E-05	0.628443913686
84	0.55556	0.00000E+00	0.628443913686
85	0.56250	0.00000E+00	0.628443913686
86	0.56410	0.00000E+00	0.628443913686
87	0.56923	0.29515E-01	0.657959152052
88	0.58696	0.67975E-05	0.657965949544
89	0.61290	0.00000E+00	0.657965949544
90	0.63158	0.00000E+00	0.657965949544
91	0.63333	0.38922E-01	0.696887622468
92	0.63636	0.21239E-04	0.696908861948

93	0.66667	0.15797E-09	0.696908862106
94	0.68182	0.00000E+00	0.696908862106
95	0.69048	0.60761E-04	0.696969623489
96	0.70270	0.00000E+00	0.696969623489
97	0.70909	0.45717E-01	0.742686522015
98	0.72414	0.83493E-09	0.742686522850
99	0.75000	0.15900E-03	0.742845522664
100	0.77778	0.00000E+00	0.742845522664
101	0.78571	0.40323E-08	0.742845526697
102	0.80000	0.47475E-01	0.790320475154
103	0.81395	0.00000E+00	0.790320475154
104	0.81579	0.38008E-03	0.790700557441
105	0.85185	0.17817E-07	0.790700575258
106	0.85714	0.00000E+00	0.790700575258
107	0.88889	0.82854E-03	0.791529114745
108	0.91111	0.43185E-01	0.834714371019
109	0.92308	0.72089E-07	0.834714443108
110	0.94118	0.00000E+00	0.834714443108
111	0.95238	0.00000E+00	0.834714443108
112	0.97059	0.16434E-02	0.836357836023
113	1.00000	0.26723E-06	0.836358103250
114	1.03030	0.00000E+00	0.836358103250
115	1.05000	0.34011E-01	0.870369234487
116	1.06250	0.29578E-02	0.873327032426
117	1.08333	0.90768E-06	0.873327940103
118	1.09756	0.00000E+00	0.873327940103
119	1.12500	0.00000E+00	0.873327940103
120	1.16667	0.48143E-02	0.878142231672
121	1.17391	0.28244E-05	0.878145056117
122	1.22581	0.00000E+00	0.878145056117
123	1.22857	0.22845E-01	0.900990020077
124	1.25000	0.00000E+00	0.900990020077
125	1.27273	0.80471E-05	0.900998067223
126	1.28571	0.70575E-02	0.908055611046
127	1.33333	0.64716E-10	0.908055611110
128	1.38095	0.20973E-04	0.908076583806
129	1.41026	0.00000E+00	0.908076583806
130	1.42308	0.92719E-02	0.917348490018

131	1.44828	0.31119E-09	0.917348490329
132	1.46667	0.12829E-01	0.930177148712
133	1.50000	0.49934E-04	0.930227082762
134	1.57143	0.13691E-08	0.930227084132
135	1.57895	0.00000E+00	0.930227084132
136	1.58333	0.10850E-01	0.941077378608
137	1.63158	0.10842E-03	0.941185799211
138	1.70370	0.55160E-08	0.941185804727
139	1.75676	0.00000E+00	0.941185804727
140	1.77273	0.11226E-01	0.952412017752
141	1.77778	0.21421E-03	0.952626226498
142	1.80000	0.58592E-02	0.958485398524
143	1.84615	0.20361E-07	0.958485418886
144	1.94118	0.38404E-03	0.958869461134
145	1.94444	0.00000E+00	0.958869461134
146	2.00000	0.10175E-01	0.969044305956
147	2.12500	0.62269E-03	0.969667000325
148	2.14286	0.00000E+00	0.969667000325
149	2.16667	0.21343E-06	0.969667213755
150	2.27778	0.79845E-02	0.977651707032
151	2.30000	0.20907E-02	0.979742399515
152	2.33333	0.90938E-03	0.980651779342
153	2.34783	0.60560E-06	0.980652384945
154	2.35294	0.00000E+00	0.980652384945
155	2.54545	0.15720E-05	0.980653956906
156	2.57143	0.11902E-02	0.981844175912
157	2.57576	0.00000E+00	0.981844175912
158	2.62500	0.53440E-02	0.987188217502
159	2.76190	0.37277E-05	0.987191945229
160	2.81250	0.00000E+00	0.987191945229
161	2.84615	0.13877E-02	0.988579602542
162	3.00000	0.80619E-05	0.988587664426
163	3.06452	0.00000E+00	0.988587664426
164	3.07143	0.29904E-02	0.991578066551
165	3.13333	0.54672E-03	0.992124786299
166	3.16667	0.14305E-02	0.993555238561
167	3.26316	0.15866E-04	0.993571104167
168	3.33333	0.12936E-10	0.993571104180

169	3.54545	0.12918E-02	0.994862860706
170	3.55556	0.28334E-04	0.994891194873
171	3.62069	0.56671E-10	0.994891194930
172	3.66667	0.13610E-02	0.996252230021
173	3.88235	0.45765E-04	0.996297995225
174	3.92857	0.22735E-09	0.996297995453
175	4.00000	0.10100E-02	0.997308027191
176	4.25000	0.66581E-04	0.997374608395
177	4.25926	0.83570E-09	0.997374609230
178	4.50000	0.48398E-03	0.997858584829
179	4.55556	0.67360E-03	0.998532189788
180	4.61538	0.28150E-08	0.998532192603
181	4.66667	0.86815E-04	0.998619007795
182	4.80000	0.93185E-04	0.998712192808
183	5.00000	0.86874E-08	0.998712201495
184	5.14286	0.10084E-03	0.998813040854
185	5.25000	0.37560E-03	0.999188643425
186	5.41667	0.24550E-07	0.999188667974
187	5.69231	0.10357E-03	0.999292233806
188	5.75000	0.12613E-03	0.999418362416
189	5.86957	0.63465E-07	0.999418425882
190	6.14286	0.17035E-03	0.999588777922
191	6.33333	0.93183E-04	0.999681960597
192	6.36364	0.14990E-06	0.999682110495
193	6.90476	0.32289E-06	0.999682433389
194	7.09091	0.72597E-04	0.999755030079
195	7.33333	0.60366E-04	0.999815396562
196	7.50000	0.63295E-06	0.999816029509
197	7.83333	0.21425E-04	0.999837454742
198	8.00000	0.48243E-04	0.999885697273
199	8.15789	0.11260E-05	0.999886823232
200	8.88889	0.18116E-05	0.999888634825
201	9.00000	0.15678E-04	0.999904313002
202	9.11111	0.26805E-04	0.999931117761
203	9.70588	0.26254E-05	0.999933743181
204	9.80000	0.77682E-05	0.999941511423
205	10.50000	0.12114E-04	0.999953625897
206	10.62500	0.34101E-05	0.999957035997

```
 207      11.50000     0.26542E-05  0.999959690185
 208      11.66667     0.39456E-05  0.999963635827
 209      12.00000     0.17801E-05  0.999965415941
 210      12.28571     0.42780E-05  0.999969693954
 211      12.85714     0.40364E-05  0.999973730328
 212      14.23077     0.36168E-05  0.999977347150
 213      14.66667     0.11073E-05  0.999978454400
 214      15.66667     0.21978E-06  0.999978674183
 215      15.83333     0.28052E-05  0.999981479407
 216      17.72727     0.18543E-05  0.999983333704
 217      18.00000     0.18680E-06  0.999983520509
 218      20.00000     0.10228E-05  0.999984543324
 219      22.77778     0.45652E-06  0.999984999839
 220      23.00000     0.15419E-07  0.999985015258
 221      26.25000     0.15670E-06  0.999985171962
 222      30.71429     0.42230E-07  0.999985214191
 223      36.66667     0.70907E-08  0.999985221282
 224      45.00000     0.58836E-09  0.999985221871
 225  999999.90000     0.14778E-04  0.999999999890

Expected value, variance and standard deviation of the
AI ratio are:    0.4495    0.4889    0.6992 respectively

CPU TIME IN SECONDS        13.02
```

8. Description of Output

The output is self-explanatory.

9. Dependencies and Acknowledgement

The present program is written in Fortran77. It was compiled to an executable code for WIN32 PCs (ie, Windows 95/98/ME, XP or NT/2000) with the GNU Fortran G77 compiler (cf. `http://www.geocities.com/Athens/Olympus/5564/`). The program uses routines from the SLATEC program library (cf. Fong et a., 1993; `http://www.geocities.com/Athens/Olympus/5564/`) and a couple of algorithms from StatLib `http://lib.stat.cmu.edu/apstat/`).

When the user reports results obtained by the present program, reference should be made to De Corte (2004) and De Corte and Lievens (2005).

10. References

De Corte (2004). SDAIZA User's Guide.

De Corte, W., & Lievens, F. (2005). The risk of adverse impact in selections based on a test with known effect size. *Educational and Psychological Measurement*, (in press).

Fong, K. W., Jefferson, T. H., Suyehiro, & Walton, L. (1993). Guide to the SLATEC common mathematical library (`http://www.netlib.org/slatec/`).