Stata code to obtain PROPr score from raw scores from PROMIS-29+2 v2.1

PROPr

\*Tianxin Pan transformed from SAS code provided by Janel Hanmer to Stata code\*

/\* DESCRIPTION

This is the multi-attribute utility function,

using isotonic regression with linear interpolation for the single-attribute (dis)utility functions.

This code was written by Janel Hanmer in September 2017 using SAS 9.4

DATASET

This code presumes the dataset's name is PROPrData

INPUTS

The input thetas must be a 7 element vector of the following form:

- theta\_cog is a score on the Cognitive Functioning - Abilities domain

- theta\_dep is a score on the Depression domain

- theta\_fat is a score on the Fatigue domain

- theta\_pain is a score on the Pain Interference domain

- theta\_phys is a score on the Physical Functioning domain

- theta\_slp is a score on the Sleep Disturbance domain

- theta\_sr is a score on the Ability to Participate in Social Roles and Activities domain

The thetas must be of the z-score form: usually a number from -3 to 3.

These are the scores constructed with a population mean of 0 and standard deviation of 1.

Note in particular, they should not be the "t-score" form.

These scores are transformations of the z-scores such that the population mean is 50 and a standard deviation of 10.

OUTPUTS

A number (utility) on the dead = 0, full health = 1 scale.

Note that 1 is the maximum possible value, but scores less than 0 are possible.

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\*\*1. get T-score for PROMIS domains

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\* new var: tscore\_dep tscore\_fat tscore\_pain tscore\_phys tscore\_slp tscore\_sr tscore\_ax tscore\_cog

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\*\*2. get theta score from T-score

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\*\*ref: PROPr technical report P41 table 14

\* raw score in PROMIS-29: score\_pi(pain intensity) raw\_dep raw\_fat raw\_pain raw\_phys raw\_slp raw\_sr raw\_ax

\* tscore\_dep tscore\_fat tscore\_pain tscore\_phys tscore\_slp tscore\_sr tscore\_ax tscore\_cog

gen theta\_dep = (tscore\_dep-50)/10

gen theta\_fat = (tscore\_fat-50)/10

gen theta\_pain = (tscore\_pain-50)/10

gen theta\_phys = (tscore\_phys-50)/10

gen theta\_slp = (tscore\_slp-50)/10

gen theta\_sr = (tscore\_sr-50)/10

\*\*\*If cog function is available

gen theta\_cog = (tscore\_cog-50)/10

/\*if cog function is not available, to calcualte PROPr from PROMIS-29, tscore\_ax is needed to predict theta\_cog

\*ref:https://doi.org/10.1016/j.jval.2019.09.2752

gen theta\_ax = (tscore\_ax-50)/10

gen theta\_cog = 0.009 + (-0.037)\*theta\_dep + 0.118\*theta\_phys + (-0.223)\*theta\_slp + 0.051\*theta\_sr +(-0.168)\*theta\_ax + (-0.006)\*score\_pi

\*/

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\*\*3. use theta score to generate PROPr score

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\*ref: https://github.com/janelhanmer/PROPr/blob/master/Generic%20MAUT%20code%202017\_09\_01.sas

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/\* Coefficients for each turn points regression \*/

gen turncog1 = -2.052

gen turncog2 =-1.565

gen turncog3 =-1.239

gen turncog4 =-0.902

gen turncog5 =-0.649

gen turncog6 =-0.367

gen turncog7 =-0.002

gen turncog8 =0.52

gen turncog9 =1.124

gen turndep1 =-1.082

gen turndep2 =-0.264

gen turndep3 =0.151

gen turndep4 =0.596

gen turndep5 =0.913

gen turndep6 =1.388

gen turndep7 =1.742

gen turndep8 =2.245

gen turndep9 =2.703

gen turnfat1 =-1.648

gen turnfat2 =-0.818

gen turnfat3 =-0.094

gen turnfat4 =0.303

gen turnfat5 =0.87

gen turnfat6 =1.124

gen turnfat7 =1.688

gen turnfat8 =2.053

gen turnfat9 =2.423

gen turnpain1 =-0.773

gen turnpain2 =0.1

gen turnpain3 =0.462

gen turnpain4 =0.827

gen turnpain5 =1.072

gen turnpain6 =1.407

gen turnpain7 =1.724

gen turnpain8 =2.169

gen turnpain9 =2.725

gen turnphys1 =-2.575

gen turnphys2 =-2.174

gen turnphys3 =-1.784

gen turnphys4 =-1.377

gen turnphys5 =-0.787

gen turnphys6 =-0.443

gen turnphys7 =-0.211

gen turnphys8 =0.16

gen turnphys9 =0.966

gen turnsleep1 =-1.535

gen turnsleep2 =-0.775

gen turnsleep3 =-0.459

gen turnsleep4 =0.093

gen turnsleep5 =0.335

gen turnsleep6 =0.82

gen turnsleep7 =1.659

gen turnsleep8 =1.934 /\*only has 8 turn point\*/

gen turnsocial1 =-2.088

gen turnsocial2 =-1.634

gen turnsocial3 =-1.293

gen turnsocial4 =-0.955

gen turnsocial5 =-0.618

gen turnsocial6 =-0.276

gen turnsocial7 =0.083

gen turnsocial8 =0.494

gen turnsocial9 =1.221

/\* Coefficients for Slopes of each line segment specification \*/

gen slopecog1 =-1.0047

gen slopecog2 =-0.1745

gen slopecog3 =-0.4223

gen slopecog4 =-0.1949

gen slopecog5 =-0.1082

gen slopecog6 =-0.2468

gen slopecog7 =-0.0176

gen slopecog8 =-0.2192

gen slopedep1 =0.1572

gen slopedep2 =0

gen slopedep3 =0.1793

gen slopedep4 =0.1817

gen slopedep5 =0.4109

gen slopedep6 =0.1887

gen slopedep7 =0.2115

gen slopedep8 =0.7983

gen slopefat1 =0.1152

gen slopefat2 =0.1077

gen slopefat3 =0.1189

gen slopefat4 =0.1277

gen slopefat5 =0.222

gen slopefat6 =0.0496

gen slopefat7 =0.3233

gen slopefat8 =1.3632

gen slopepain1 =0.0891

gen slopepain2 =0.1721

gen slopepain3 =0.1022

gen slopepain4 =0.4241

gen slopepain5 =0.3815

gen slopepain6 =0.3681

gen slopepain7 =0.1169

gen slopepain8 =0.7594

gen slopephys1 =-1.0761

gen slopephys2 =-0.1756

gen slopephys3 =-0.1764

gen slopephys4 =-0.1161

gen slopephys5 =-0.2721

gen slopephys6 =-0.4082

gen slopephys7 =-0.1695

gen slopephys8 =-0.1346

gen slopesleep1 =0.1241

gen slopesleep2 =0

gen slopesleep3 =0.0797

gen slopesleep4 =0.3455

gen slopesleep5 =0.3148

gen slopesleep6 =0.1238

gen slopesleep7 =1.8964

gen slopesocial1 =-1.1152

gen slopesocial2 =-0.2874

gen slopesocial3 =-0.1352

gen slopesocial4 =-0.132

gen slopesocial5 =-0.4012

gen slopesocial6 =0

gen slopesocial7 =-0.054

gen slopesocial8 =-0.201

/\* Coefficients for each intercept points regression \*/

gen interceptcog1 =-1.0617

gen interceptcog2 =0.2375

gen interceptcog3 =-0.0694

gen interceptcog4 =0.1357

gen interceptcog5 =0.192

gen interceptcog6 =0.1411

gen interceptcog7 =0.1416

gen interceptcog8 =0.2464

gen interceptdep1 =0.1701

gen interceptdep2 =0.1286

gen interceptdep3 =0.1015

gen interceptdep4 =0.1001

gen interceptdep5 =-0.1092

gen interceptdep6 =0.1993

gen interceptdep7 =0.1595

gen interceptdep8 =-1.1577

gen interceptfat1 =0.1898

gen interceptfat2 =0.1837

gen interceptfat3 =0.1848

gen interceptfat4 =0.1821

gen interceptfat5 =0.1

gen interceptfat6 =0.2938

gen interceptfat7 =-0.1681

gen interceptfat8 =-2.3031

gen interceptpain1 =0.0689

gen interceptpain2 =0.0606

gen interceptpain3 =0.0929

gen interceptpain4 =-0.1733

gen interceptpain5 =-0.1277

gen interceptpain6 =-0.1089

gen interceptpain7 =0.3243

gen interceptpain8 =-1.0692

gen interceptphys1 =-1.7709

gen interceptphys2 =0.1867

gen interceptphys3 =0.1853

gen interceptphys4 =0.2683

gen interceptphys5 =0.1456

gen interceptphys6 =0.0853

gen interceptphys7 =0.1356

gen interceptphys8 =0.13

gen interceptsleep1 =0.1905

gen interceptsleep2 =0.0943

gen interceptsleep3 =0.1309

gen interceptsleep4 =0.1062

gen interceptsleep5 =0.1164

gen interceptsleep6 =0.2731

gen interceptsleep7 =-2.6676

gen interceptsocial1 =-1.3285

gen interceptsocial2 =0.0241

gen interceptsocial3 =0.2209

gen interceptsocial4 =0.2239

gen interceptsocial5 =0.0576

gen interceptsocial6 =0.1683

gen interceptsocial7 =0.1728

gen interceptsocial8 =0.2454

/\* Corner state disutilities\*/

gen c\_cognition = 0.6350450

gen c\_depression = 0.6661641

gen c\_fatigue = 0.6386135

gen c\_pain = 0.6529680

gen c\_physical = 0.6883584

gen c\_sleep = 0.5629657

gen c\_social = 0.6112686

gen C = -0.9991828

/\* Constant for transforming from pits to dead \*/

gen to\_dead = 1.021915

/\* Create the output of each single-domain function\*/

/\* Cognition Disutility. Higher cognition scores are better.\*/

gen cog\_disutility = 1

replace cog\_disutility = interceptcog1 + theta\_cog \* slopecog1 if turncog1<= theta\_cog & theta\_cog< turncog2

replace cog\_disutility = interceptcog2 + theta\_cog \* slopecog2 if turncog2<= theta\_cog & theta\_cog< turncog3

replace cog\_disutility = interceptcog3 + theta\_cog \* slopecog3 if turncog3<= theta\_cog & theta\_cog< turncog4

replace cog\_disutility = interceptcog4 + theta\_cog \* slopecog4 if turncog4<= theta\_cog & theta\_cog< turncog5

replace cog\_disutility = interceptcog5 + theta\_cog \* slopecog5 if turncog5<= theta\_cog & theta\_cog< turncog6

replace cog\_disutility = interceptcog6 + theta\_cog \* slopecog6 if turncog6<= theta\_cog & theta\_cog< turncog7

replace cog\_disutility = interceptcog7 + theta\_cog \* slopecog7 if turncog7<= theta\_cog & theta\_cog< turncog8

replace cog\_disutility = interceptcog8 + theta\_cog \* slopecog8 if turncog8<= theta\_cog & theta\_cog< turncog9

replace cog\_disutility = 0 if turncog9<= theta\_cog

/\* Depression Disutility. Lower depression scores are better\*/

gen dep\_disutility=0

replace dep\_disutility = interceptdep1 + theta\_dep \* slopedep1 if turndep1<= theta\_dep & theta\_dep< turndep2

replace dep\_disutility = interceptdep2 + theta\_dep \* slopedep2 if turndep2<= theta\_dep & theta\_dep< turndep3

replace dep\_disutility = interceptdep3 + theta\_dep \* slopedep3 if turndep3<= theta\_dep & theta\_dep< turndep4

replace dep\_disutility = interceptdep4 + theta\_dep \* slopedep4 if turndep4<= theta\_dep & theta\_dep< turndep5

replace dep\_disutility = interceptdep5 + theta\_dep \* slopedep5 if turndep5<= theta\_dep & theta\_dep< turndep6

replace dep\_disutility = interceptdep6 + theta\_dep \* slopedep6 if turndep6<= theta\_dep & theta\_dep< turndep7

replace dep\_disutility = interceptdep7 + theta\_dep \* slopedep7 if turndep7<= theta\_dep & theta\_dep< turndep8

replace dep\_disutility = interceptdep8 + theta\_dep \* slopedep8 if turndep8<= theta\_dep & theta\_dep< turndep9

replace dep\_disutility = 1 if turndep9<= theta\_dep

/\* Fatigue Disutility. Lower fatigue scores are better\*/

gen fat\_disutility=0

replace fat\_disutility = interceptfat1 + theta\_fat \* slopefat1 if turnfat1<= theta\_fat & theta\_fat< turnfat2

replace fat\_disutility = interceptfat2 + theta\_fat \* slopefat2 if turnfat2<= theta\_fat & theta\_fat< turnfat3

replace fat\_disutility = interceptfat3 + theta\_fat \* slopefat3 if turnfat3<= theta\_fat & theta\_fat< turnfat4

replace fat\_disutility = interceptfat4 + theta\_fat \* slopefat4 if turnfat4<= theta\_fat & theta\_fat< turnfat5

replace fat\_disutility = interceptfat5 + theta\_fat \* slopefat5 if turnfat5<= theta\_fat & theta\_fat< turnfat6

replace fat\_disutility = interceptfat6 + theta\_fat \* slopefat6 if turnfat6<= theta\_fat & theta\_fat< turnfat7

replace fat\_disutility = interceptfat7 + theta\_fat \* slopefat7 if turnfat7<= theta\_fat & theta\_fat< turnfat8

replace fat\_disutility = interceptfat8 + theta\_fat \* slopefat8 if turnfat8<= theta\_fat & theta\_fat< turnfat9

replace fat\_disutility = 1 if turnfat9<= theta\_fat

/\* Pain Disutility. Lower pain scores are better\*/

gen pain\_disutility=0

replace pain\_disutility = interceptpain1 + theta\_pain \* slopepain1 if turnpain1<= theta\_pain & theta\_pain< turnpain2

replace pain\_disutility = interceptpain2 + theta\_pain \* slopepain2 if turnpain2<= theta\_pain & theta\_pain< turnpain3

replace pain\_disutility = interceptpain3 + theta\_pain \* slopepain3 if turnpain3<= theta\_pain & theta\_pain< turnpain4

replace pain\_disutility = interceptpain4 + theta\_pain \* slopepain4 if turnpain4<= theta\_pain & theta\_pain< turnpain5

replace pain\_disutility = interceptpain5 + theta\_pain \* slopepain5 if turnpain5<= theta\_pain & theta\_pain< turnpain6

replace pain\_disutility = interceptpain6 + theta\_pain \* slopepain6 if turnpain6<= theta\_pain & theta\_pain< turnpain7

replace pain\_disutility = interceptpain7 + theta\_pain \* slopepain7 if turnpain7<= theta\_pain & theta\_pain< turnpain8

replace pain\_disutility = interceptpain8 + theta\_pain \* slopepain8 if turnpain8<= theta\_pain & theta\_pain< turnpain9

replace pain\_disutility = 1 if turnpain9<= theta\_pain

/\* Physical Disutility. higher physical function scores are better\*/

gen physical\_disutility = 1

replace physical\_disutility = interceptphys1 + theta\_phys \* slopephys1 if turnphys1<= theta\_phys & theta\_phys< turnphys2

replace physical\_disutility = interceptphys2 + theta\_phys \* slopephys2 if turnphys2<= theta\_phys & theta\_phys< turnphys3

replace physical\_disutility = interceptphys3 + theta\_phys \* slopephys3 if turnphys3<= theta\_phys & theta\_phys< turnphys4

replace physical\_disutility = interceptphys4 + theta\_phys \* slopephys4 if turnphys4<= theta\_phys & theta\_phys< turnphys5

replace physical\_disutility = interceptphys5 + theta\_phys \* slopephys5 if turnphys5<= theta\_phys & theta\_phys< turnphys6

replace physical\_disutility = interceptphys6 + theta\_phys \* slopephys6 if turnphys6<= theta\_phys & theta\_phys< turnphys7

replace physical\_disutility = interceptphys7 + theta\_phys \* slopephys7 if turnphys7<= theta\_phys & theta\_phys< turnphys8

replace physical\_disutility = interceptphys8 + theta\_phys \* slopephys8 if turnphys8<= theta\_phys & theta\_phys< turnphys9

replace physical\_disutility = 0 if turnphys9<= theta\_phys

/\* Sleep Disutility. Lower sleep disturbance scores are better\*/

gen sleep\_disutility=0

replace sleep\_disutility = interceptsleep1 + theta\_slp \* slopesleep1 if turnsleep1<= theta\_slp & theta\_slp< turnsleep2

replace sleep\_disutility = interceptsleep2 + theta\_slp \* slopesleep2 if turnsleep2<= theta\_slp & theta\_slp< turnsleep3

replace sleep\_disutility = interceptsleep3 + theta\_slp \* slopesleep3 if turnsleep3<= theta\_slp & theta\_slp< turnsleep4

replace sleep\_disutility = interceptsleep4 + theta\_slp \* slopesleep4 if turnsleep4<= theta\_slp & theta\_slp< turnsleep5

replace sleep\_disutility = interceptsleep5 + theta\_slp \* slopesleep5 if turnsleep5<= theta\_slp & theta\_slp< turnsleep6

replace sleep\_disutility = interceptsleep6 + theta\_slp \* slopesleep6 if turnsleep6<= theta\_slp & theta\_slp< turnsleep7

replace sleep\_disutility = interceptsleep7 + theta\_slp \* slopesleep7 if turnsleep7<= theta\_slp & theta\_slp< turnsleep8

replace sleep\_disutility = 1 if turnsleep8<= theta\_slp

/\* Social Disutility. Higher social scores are better\*/

gen social\_disutility = 1

replace social\_disutility = interceptsocial1 + theta\_sr \* slopesocial1 if turnsocial1<= theta\_sr & theta\_sr< turnsocial2

replace social\_disutility = interceptsocial2 + theta\_sr \* slopesocial2 if turnsocial2<= theta\_sr & theta\_sr< turnsocial3

replace social\_disutility = interceptsocial3 + theta\_sr \* slopesocial3 if turnsocial3<= theta\_sr & theta\_sr< turnsocial4

replace social\_disutility = interceptsocial4 + theta\_sr \* slopesocial4 if turnsocial4<= theta\_sr & theta\_sr< turnsocial5

replace social\_disutility = interceptsocial5 + theta\_sr \* slopesocial5 if turnsocial5<= theta\_sr & theta\_sr< turnsocial6

replace social\_disutility = interceptsocial6 + theta\_sr \* slopesocial6 if turnsocial6<= theta\_sr & theta\_sr< turnsocial7

replace social\_disutility = interceptsocial7 + theta\_sr \* slopesocial7 if turnsocial7<= theta\_sr & theta\_sr< turnsocial8

replace social\_disutility = interceptsocial8 + theta\_sr \* slopesocial8 if turnsocial8<= theta\_sr & theta\_sr< turnsocial9

replace social\_disutility = 0 if turnsocial9<= theta\_sr

/\* Now, plug it into the multiattribute disutility function \*/

gen multi\_attribute\_disutility = (1/C) \* ((1 + C \* c\_cognition \* cog\_disutility)\* ///

(1 + C \* c\_depression \* dep\_disutility)\* (1 + C \* c\_fatigue \* fat\_disutility)\* ///

(1 + C \* c\_pain \* pain\_disutility)\* (1 + C \* c\_physical \* physical\_disutility)\* ///

(1 + C \* c\_sleep \* sleep\_disutility)\* (1 + C \* c\_social \* social\_disutility) - 1)

/\* Now make it a utility, on the dead/full health scale \*/

gen PROPr = round(1 - to\_dead \* multi\_attribute\_disutility, 0.001)

/\* single attribute utility functions \*/

gen cognition\_utility = round(1 - cog\_disutility, 0.001)

gen depression\_utility = round(1 - dep\_disutility, 0.001)

gen fatigue\_utility = round(1 - fat\_disutility, 0.001)

gen pain\_utility = round(1 - pain\_disutility, 0.001)

gen physical\_utility = round(1 - physical\_disutility, 0.001)

gen sleep\_utility = round(1 - sleep\_disutility, 0.001)

gen social\_utility = round(1 - social\_disutility, 0.001)

\* clean up dataset

drop multi\_attribute\_disutility to\_dead ///

turncog1 turncog2 turncog3 turncog4 turncog5 turncog6 turncog7 turncog8 turncog9 ///

turndep1 turndep2 turndep3 turndep4 turndep5 turndep6 turndep7 turndep8 turndep9 ///

turnfat1 turnfat2 turnfat3 turnfat4 turnfat5 turnfat6 turnfat7 turnfat8 turnfat9 ///

turnpain1 turnpain2 turnpain3 turnpain4 turnpain5 turnpain6 turnpain7 turnpain8 turnpain9 ///

turnphys1 turnphys2 turnphys3 turnphys4 turnphys5 turnphys6 turnphys7 turnphys8 turnphys9 ///

turnsleep1 turnsleep2 turnsleep3 turnsleep4 turnsleep5 turnsleep6 turnsleep7 turnsleep8 ///

turnsocial1 turnsocial2 turnsocial3 turnsocial4 turnsocial5 turnsocial6 turnsocial7 turnsocial8 turnsocial9 ///

slopecog1 slopecog2 slopecog3 slopecog4 slopecog5 slopecog6 slopecog7 slopecog8 ///

slopedep1 slopedep2 slopedep3 slopedep4 slopedep5 slopedep6 slopedep7 slopedep8 ///

slopefat1 slopefat2 slopefat3 slopefat4 slopefat5 slopefat6 slopefat7 slopefat8 ///

slopepain1 slopepain2 slopepain3 slopepain4 slopepain5 slopepain6 slopepain7 slopepain8 ///

slopephys1 slopephys2 slopephys3 slopephys4 slopephys5 slopephys6 slopephys7 slopephys8 ///

slopesleep1 slopesleep2 slopesleep3 slopesleep4 slopesleep5 slopesleep6 slopesleep7 ///

slopesocial1 slopesocial2 slopesocial3 slopesocial4 slopesocial5 slopesocial6 slopesocial7 slopesocial8 ///

interceptcog1 interceptcog2 interceptcog3 interceptcog4 interceptcog5 interceptcog6 interceptcog7 interceptcog8 ///

interceptdep1 interceptdep2 interceptdep3 interceptdep4 interceptdep5 interceptdep6 interceptdep7 interceptdep8 ///

interceptfat1 interceptfat2 interceptfat3 interceptfat4 interceptfat5 interceptfat6 interceptfat7 interceptfat8 ///

interceptpain1 interceptpain2 interceptpain3 interceptpain4 interceptpain5 interceptpain6 interceptpain7 interceptpain8 ///

interceptphys1 interceptphys2 interceptphys3 interceptphys4 interceptphys5 interceptphys6 interceptphys7 interceptphys8 ///

interceptsleep1 interceptsleep2 interceptsleep3 interceptsleep4 interceptsleep5 interceptsleep6 interceptsleep7 ///

interceptsocial1 interceptsocial2 interceptsocial3 interceptsocial4 interceptsocial5 interceptsocial6 interceptsocial7 interceptsocial8 ///

c\_cognition c\_depression c\_fatigue c\_pain c\_physical c\_sleep c\_social C ///

cog\_disutility dep\_disutility fat\_disutility pain\_disutility physical\_disutility sleep\_disutility social\_disutility