```
%let dataDEApath="C:\Users\pboily\Desktop\IACS\Projects\BASA\falsified.csv";

%let filename="DEAprogram.sas";
%let filename2="DEAend.sas";
%let threshold=20;
%let max_o4=10;
%let i1_reversal=1;
%let i2_reversal=1;
%let i3_reversal=1;
%let i4_reversal=1;
%let i5_reversal=1;
%let i1_expo=1;
%let i2_expo=1;
%let i3_expo=1;
%let i4_expo=1;
%let i5_expo=1;
%let o1_expo=2;
%let o2_expo=2;
%let o3_expo=2;
%let o4_expo=2;
%let o5_expo=2;


PROC IMPORT OUT= SASUSER.Data
            DATAFILE= &dataDEApath.
            DBMS=CSV REPLACE;
     GETNAMES=YES;
     DATAROW=2;
RUN;

%macro prepare_data(air,PTFT_threshold,tips_freq,DEAname,randomname,scenname);
data sasuser.data;
      set sasuser.data;
      TIPS_TN_Count=TIPS_Count*(&tips_freq.-1)-TIPS_False_Count;
      TIPS_2nd_Column=TIPS_Count*(&tips_freq.-1);
run;

data data_DEA;
      set sasuser.data;
      if filter=1 and (VT_SO_Pass_Count le VT_SO_Test_Count) and (CS_Session_Pass_Count
le CS_Session_Count) and (TIPS_Pass_Count le TIPS_Count) and (TIPS_TN_Count le
TIPS_2nd_Column);
run;

data data_random;
      set sasuser.data;
      if filter=0 or (VT_SO_Pass_Count > VT_SO_Test_Count) or (CS_Session_Pass_Count >
CS_Session_Count) or (TIPS_Pass_Count > TIPS_Count) or (TIPS_TN_Count > TIPS_2nd_Column);
run;

data data_DEA(drop=Filter Start_Date Cut_off Length_of_Employment RLP_Exam_A RLP_Exam_B
MAX_RLP PE_StartDate);
      set data_DEA;
      i1=Average_Time_Per_Level;
      i2=GRT_Score;
      i3=aTIX_Screened_Bags;
      i4=rev_aTIX_Bags_per_Hour;
      i5=SITT_PBS_Hours_Worked;
run;
```

```
data data_DEA(keep=LMS Airfield Region Length_of_Employment_Status SO_Status PBS_Status
i1 i2 i3 i4 i5 o4 VT_SO_Test_Count VT_SO_Pass_Count CS_Session_Count
CS_Session_Pass_Count TIPS_Count TIPS_Pass_Count TIPS_TN_Count TIPS_2nd_Column);
      set data_DEA;
      if Avg_PBS_Hours_Per_Active_Day<&PTFT_threshold. then PBS_Status="PT";
      else if Avg_PBS_Hours_Per_Active_Day ge &PTFT_threshold. then PBS_Status="FT";
      if PE_Count="" then PE_Count=0;
      if i3 ne 0 then o4=1-PE_Count/i3;
      else o4=.;
      if VT_SO_Test_Count in (".","") then VT_SO_Test_Count=0;
      if VT_SO_Pass_Count in (".","") then VT_SO_Pass_Count=0;
      if CS_Session_Count in (".","") then CS_Session_Count=0;
      if CS_Session_Pass_Count in (".","") then CS_Session_Pass_Count=0;
      if TIPS_Count in (".","") then TIPS_Count=0;
      if TIPS_Pass_Count in (".","") then TIPS_Pass_Count=0;
      if TIPS_TN_Count in (".","") then TIPS_TN_Count=0;
      if TIPS_2nd_Column in (".","") then TIPS_2nd_Column=0;
run;

proc sort data=data_DEA;
      by Length_of_Employment_Status PBS_Status;
run;

proc means data=data_DEA noprint sum;
      by Length_of_Employment_Status PBS_Status;
      var VT_SO_Test_Count VT_SO_Pass_Count CS_Session_Count CS_Session_Pass_Count
TIPS_Count TIPS_Pass_Count TIPS_TN_Count TIPS_2nd_Column;
      output out=data_DEA_sum sum= / autoname;
run;

proc means data=data_DEA noprint sum;
      var VT_SO_Test_Count VT_SO_Pass_Count CS_Session_Count CS_Session_Pass_Count
TIPS_Count TIPS_Pass_Count TIPS_TN_Count TIPS_2nd_Column;
      output out=data_DEA_sum2 sum= / autoname;
run;

data data_DEA_sum(keep=Length_of_Employment_Status PBS_Status k_VT k_CS k_T1 k_T2
unique);
      set data_DEA_sum;
      m_VT=VT_SO_Pass_Count_Sum/VT_SO_Test_Count_Sum;
      m_CS=CS_Session_Pass_Count_Sum/CS_Session_Count_Sum;
      m_T1=TIPS_Pass_Count_Sum/TIPS_Count_Sum;
      m_T2=TIPS_TN_Count_Sum/TIPS_2nd_Column_Sum;
      k_VT=m_VT/(1-m_VT);
      k_CS=m_CS/(1-m_CS);
      k_T1=m_T1/(1-m_T1);
      k_T2=m_T2/(1-m_T2);
      unique=1;
run;

data data_DEA_sum2(keep=k_VT2 k_CS2 k_T12 k_T22 unique);
      set data_DEA_sum2;
      m_VT=VT_SO_Pass_Count_Sum/VT_SO_Test_Count_Sum;
      m_CS=CS_Session_Pass_Count_Sum/CS_Session_Count_Sum;
      m_T1=TIPS_Pass_Count_Sum/TIPS_Count_Sum;
      m_T2=TIPS_TN_Count_Sum/TIPS_2nd_Column_Sum;
      k_VT2=m_VT/(1-m_VT);
      k_CS2=m_CS/(1-m_CS);
      k_T12=m_T1/(1-m_T1);
      k_T22=m_T2/(1-m_T2);
      unique=1;
run;
```

```
data data_DEA_sum(keep=Length_of_Employment_Status PBS_Status k_VT k_CS k_T1 k_T2);
      merge data_DEA_sum data_DEA_sum2;
      by unique;
      if k_VT=. then k_VT=k_VT2;
      if k_CS=. then k_CS=k_CS2;
      if k_T1=. then k_T1=k_T12;
      if k_T2=. then k_T2=k_T22;
run;

data &DEAname.(keep=LMS Airfield Region Length_of_Employment_Status SO_Status PBS_Status
i1 i2 i3 i4 i5 o1 o2 o3 o4 o5);
      merge data_DEA(in=a) data_DEA_sum(in=b);
      by Length_of_Employment_Status PBS_Status;
      if a;
      o1=(VT_SO_Pass_Count+k_VT)/(VT_SO_Test_Count+k_VT+1);
      o2=(TIPS_Pass_Count+k_T1)/(TIPS_Count+k_T1+1);
      o3=(TIPS_TN_Count+k_T2)/(TIPS_2nd_Column+k_T2+1);
      o5=(CS_Session_Pass_Count+k_CS)/(CS_Session_Count+k_CS+1);
run;

/*-1 for switching the direction of inputs*/
data &DEAname.;
      set &DEAname.;
      i1=&i1_reversal.*i1;
      i2=&i2_reversal.*i2;
      i3=&i3_reversal.*i3;
      i4=&i4_reversal.*i4;
      i5=&i5_reversal.*i5;
      unique=1;
run;

proc means data=&DEAname. noprint;
      var i1 i2 i3 i4 i5 o1 o2 o3 o4 o5;
      output out=min_max min= max= /autoname;
run;

data min_max;
      set min_max;
      unique=1;
      /* comment out to get scale from real min to real max */
      if &i1_reversal.=1 then i1_min=0;
      else i1_max=0;
      if &i2_reversal.=1 then i2_min=0;
      else i2_max=0;
      if &i3_reversal.=1 then i3_min=0;
      else i3_max=0;
      if &i4_reversal.=1 then i4_min=0;
      else i4_max=0;
      if &i5_reversal.=1 then i5_min=0;
      else i5_max=0;
      o1_min=0;
      o2_min=0;
      o3_min=0;
      /*o4_min=0;*/ /* want to penalize poor performers on this front */
      o5_min=0;
      o1_max=1;
      o4_max=1;
      o5_max=1;
run;
```

```
/* scaling variables on a scale of 0 to 1 */
data &DEAname.(drop=_TYPE_ _FREQ_ i1_min i2_min i3_min i4_min i5_min o1_min o2_min o3_min
o4_min o5_min i1_max i2_max i3_max i4_max i5_max o1_max o2_max o3_max o4_max o5_max
unique);
      merge &DEAname. min_max;
      by unique;
      i1=-(i1-i1_min)/(i1_min-i1_max);
      i2=-(i2-i2_min)/(i2_min-i2_max);
      i3=-(i3-i3_min)/(i3_min-i3_max);
      i4=-(i4-i4_min)/(i4_min-i4_max);
      i5=-(i5-i5_min)/(i5_min-i5_max);
      o1=-(o1-o1_min)/(o1_min-o1_max);
      o2=-(o2-o2_min)/(o2_min-o2_max);
      o3=-(o3-o3_min)/(o3_min-o3_max);
      o4=-(o4-o4_min)/(o4_min-o4_max);
      o5=-(o5-o5_min)/(o5_min-o5_max);
      if i1 = . then i1=0.5;
      if i2 = . then i2=0.5;
      if i3 = . then i3=0.5;
      if i4 = . then i4=0.5;
      if i5 = . then i5=0.5;
      if o1 = . then o1=0.5;
      if o2 = . then o2=0.5;
      if o3 = . then o3=0.5;
      if o4 = . then o4=0.5;
      if o5 = . then o5=0.5;
run;

data &DEAname.;
      set &DEAname.;
      i1=i1**&i1_expo.;
      i2=i2**&i2_expo.;
      i3=i3**&i3_expo.;
      i4=i4**&i4_expo.;
      i5=i5**&i5_expo.;
      o1=o1**&o1_expo.;
      o2=o2**&o2_expo.;
      o3=o3**&o3_expo.;
      o4=o4**&o4_expo.;
      o5=o5**&o5_expo.;
run;

data sasuser.&randomname.;
      set data_random;
run;

data testdata;
      set &DEAname.;
run;

      %macro DEA_various_constraints(eps);
      data testdata;
            set testdata;
            Unit=_N_;
            optimand = "max f = " || strip(o1) || strip("*x[6]+") || strip(o2) ||
strip("*x[7]+") || strip(o3) || strip("*x[8]+") || strip(o4) || strip("*x[9]+") ||
strip(o5) || strip("*x[10]") || strip(";");
            input_constraint = "con c0: " || strip(i1) || strip("*x[1]+") || strip(i2) ||
strip("*x[2]+") || strip(i3) || strip("*x[3]+") || strip(i4) || strip("*x[4]+") ||
strip(i5) || strip("*x[5]") || strip(" = 100;");
            constraint = strip("con c") || strip(_n_) || ": " || "-" || strip(i1) ||
strip("*x[1]-") || strip(i2) || strip("*x[2]-") || strip(i3) || strip("*x[3]-") ||
strip(i4) || strip("*x[4]-") || strip(i5) || strip("*x[5]+") || strip(o1) ||
strip("*x[6]+") || strip(o2) || strip("*x[7]+") || strip(o3) || strip("*x[8]+") ||
strip(o4) || strip("*x[9]+") || strip(o5) || strip("*x[10]") || strip("<=0") ||
strip(";");
            score = "DEA_Score = " || strip("COL6*o1+") || strip("COL7*o2+") ||
strip("COL8*o3+") || strip("COL9*o4+") || strip("COL10*o5") || strip(";");
      run;

      data _null_;
            set testdata end=eof;
            if eof then do;
                  call symput("numobs",_N_);
            end;
      run;

            %macro GenerateAndSolveDEA(index);

            data testdata;
                  set testdata;
                  if Unit=&index. then indicator=0;
                  else indicator = Unit;
            run;

            proc sort data=testdata;
                  by indicator;
            run;

            data _null_ ;
                  file &filename.;
                  set testdata end=eof;
                  if _N_ =1 then do;
                        put "proc optmodel; "
                        / "    var x{i in 1..10} >= 0;"
                        / optimand
                        / input_constraint
                  / "    con c0001: x[1] >= &eps./2;" /* i1 Average GRT time in
                                                                        mins per level */
                  / "    con c0002: x[2] = 0;"        /*  REVERSED GRT %Pass */
                  / "    con c0003: x[3] = 0;"        /* i3 aTiX screened bags */
                  / "    con c0004: x[4] >= &eps.;"   /* i4 REVERSED aTiX bags/hr rate */
                  / "    con c0005: x[5] = &max_o4./4;" /* i5 SITT PBS hours */
                  / "    con c0006: x[6] >= &eps.;"   /* o1 VT %Pass */
                  / "    con c0007: x[7] >= &eps./2;" /* o2 TIPS %Pass */
                  / "    con c0008: x[8] >= &eps./2;" /* o3 TIPS %TN */
                  / "    con c0009: x[9] = &max_o4.;" /* o4 %PE */
                  / "    con c0010: x[10] >= &eps.;"  /* o5 CS %Pass */
                  / "    con c0011: x[7] - x[8] = 0;" /* TIPS & TN set to equal weight */
                        / constraint;
                  end;

                        if _N_>1 then do;
                  put constraint;
                  end;

                  if eof then do;
                        put "    solve with lp / solver = ps presolver = basic;"
                                                                  /*printfreq = 1;"*/
                        / "    create data weights from [i] weights=x;"
                        / "quit;";
                  end;
            run;

            %include &filename.;
            proc transpose data=weights out=weights;
            run;

            data weights(drop=_NAME_);
                  set weights;
                  Unit=&index.;
                  if _N_>1 then output;
            run;

            proc sort data=testdata;
                  by Unit;
            run;

            data testdata;
                  merge testdata weights;
                  by Unit;
            run;

            %mend GenerateAndSolveDEA;

      %macro TheWholeThing;
            %do prob = 1 %to &numobs.;
                  %GenerateAndSolveDEA(&prob.);
            %end;
      %mend TheWholeThing;

      %TheWholeThing;

      data _null_ ;
            file &filename2.;
            set testdata end=eof;
            if _N_ =1 then do;
                  put "data &DEAname.(drop=optimand input_constraint constraint score);"
                        / "    set testdata;"
                        / score;
            end;
            if eof then do;
                  put "run;";
            end;
      run;

      %include &filename2.;

      data &DEAname._&eps.;
            set &DEAname.;
            rename col1=wi1_&eps.;
            rename col2=wi2_&eps.;
            rename col3=wi3_&eps.;
            rename col4=wi4_&eps.;
            rename col5=wi5_&eps.;
            rename col6=wo1_&eps.;
            rename col7=wo2_&eps.;
            rename col8=wo3_&eps.;
            rename col9=wo4_&eps.;
            rename col10=wo5_&eps.;
            if DEA_Score<0 then DEA_Score=0;
            else if DEA_Score>100 then DEA_Score=100;
            rename DEA_Score=DEA_Score&eps.;
      run;

      %mend DEA_various_constraints;

%DEA_various_constraints(&threshold.);
```

```
data sasuser.&DEAname.;
      set &DEAname._&threshold.;
      by Unit;
run;

data sasuser.&DEAname.(keep=LMS Airfield Region Length_of_Employment_Status SO_Status
PBS_Status i1-i5 o1-o5 wi1_&threshold. wi2_&threshold. wi3_&threshold. wi4_&threshold.
wi5_&threshold. wo1_&threshold. wo2_&threshold. wo3_&threshold. wo4_&threshold.
wo5_&threshold. DEA_Score&threshold. flag);
      set sasuser.&DEAname.;
      if o1+o2+o3+o4+o5=0 then flag=-1;
      else flag=0;
      Filter=1;
run;

data sasuser.&DEAname. rando;
      set sasuser.&DEAname;
      if flag=0 then output sasuser.&DEAname.;
      else output rando;
run;

data sasuser.&randomname.(keep=LMS Airfield Region Filter);
      set sasuser.&randomname. rando;
run;

%mend prepare_data;

%prepare_data('BYT',5,40,BYT_DEA,BYT_random);
```