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% Supplementary 1 - Matlab code

% MatLAB implementation and simulation of the Sniffin' Sticks threshold, discrimination,
identification test on different sample sizes (100,000, 1,000,000, 10,000,000, 100,000,000,
1,000,000,000).



clear all;


%Determining the sample size

samplesize=1000000000;


%Initialization of the results, the number in the names means the number of

%alternatives in the Identification subtest

%result2=zeros(samplesize,1);

%result3=zeros(samplesize,1);

%result4=zeros(samplesize,1);

%result5=zeros(samplesize,1);

%result6=zeros(samplesize,1);

%result7=zeros(samplesize,1);

%result8=zeros(samplesize,1);

%result9=zeros(samplesize,1);

result10=zeros(samplesize,1);


%For cicle for the number of alternatives in the Identification subtest

%Because of the potential large size of the results, it can be better to run this one by one

for identi = 10:10

for indexi = 1:samplesize


%The parameters of the discrimination subtest

hitD = 1/3;          %The possibility that we hit the right answer in the Discrimination subtest

Dpoint = 0;          %The number of scored points in the Discrimination subtest

experimentnumberD = 16; %How many experiments we run in the Discrimination subtest
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%The parameters of the Identification subtest
hitI = 1/identi;       %The possibility that we hit the right answer in the Identification subtest
Ipoint = 0;            %The number of scored points in the Identification subtest
experimentnumberI = 16; %How many experiments we run in the Identification subtest
%%
%Simulation of the Threshold subtest
hit = 1/3;             %The possibility that we hit the right answer
level = 16;            %The level of concentration (the higher the level, the smaller the concentration)
round = 1;             %In which round we are
roundpoint = 0;        %What is the score of the round
points = zeros(1,7);    %The scores of all rounds (initialization)

%First round
if round == 1

  %While there was no roundpoint, and we have not reached level 0
  while roundpoint == 0 && level > 0

   if rand() <= hit

      %If we hit it twice in a row, there is a roundpoint
      if rand() <= hit
         roundpoint = level;
      else %If not, the the concentration parameter is lowered by 2 levels
         level = level-2;
      end;
   else
      level = level-2;
   end;
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  end;

  %We save the score, if it would be 0 points, then it will be 1, and we modify the level of
concentration
   if level == 0
      points(round) = 1;
      roundpoint = 1;
   else
   points(round) = roundpoint;
   end;
end;



%2nd round
round = 2;

%We are running 7 rounds
while round <= 7

%In the even rounds we examine higher levels of concentration parameters
if mod(round,2) == 0

   if level < 16
   level = level + 1;
   end;

  %While the roundpoint is the same as in the previous round, and we have
  %not reached level 16 yet
  while roundpoint == points(round-1) && level <16

   if rand() <= hit
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      %If we hit it twice in a row, then we increase the level of the concentration
      %parameter
      if rand() <= hit
         level = level + 1;
      else %If not, then there is a roundpoint
         %We handle the case, when the subject did not hit the right
         %answer even for the lowest level of the concentration parameter
        if level>1
           roundpoint = level;
        else
           roundpoint = 0;
        end;
      end;
   else %We handle the case, when the subject did not hit the right
       %answer even for the lowest level of the concentration parameter
      if level>1
           roundpoint = level;
        else
           roundpoint = 0;
        end;
    end;


  end;

%We handle the case, when the subject hit the right
%answer even for the highest level of the concentration parameter
if level == 16
    roundpoint = 16;
end;
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```
%We handle the case, when the subject did not hit the right
%answers even for the lowest level of the concentration parameter
if level == 1
    roundpoint = 1;
end;

%We save the score
   points(round) = roundpoint;

%Increase the number of rounds by 1
round = round + 1;
end;



%When we are in an odd round
if mod(round,2) == 1

   %Decreasing the parameter of the concentration level by 1
   if level > 1
   level = level - 1;
   end;

%While the roundpoint is the same as in the previous round, and the concentration level is at least 1
%we decrease the parameter of the concentration level
while roundpoint == points(round-1) && level >=1
if rand() <= hit

      %If we hit the right answer twice, then there is a roundpoint
      if rand() <= hit
         roundpoint = level;
      else %If not, then we further decrease the concentration level
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        level = level-1;
      end;
   else
      level = level-1;
   end;
end;

%Saving the score, and handling the case of level 0
if level == 0
    points(round) = 1;
    roundpoint = 1;
else
    points(round) = roundpoint;
end;

round = round +1;
end;
end;



Tpoint=(points(4) + points(5) + points(6) + points(7))/4;

%%

%Simulation of the discrimination subtest

for indexj = 1:experimentnumberD
if rand() <= hitD
   Dpoint = Dpoint+1;
end;
end;
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%Simulation of the identification subtest

for indexj = 1:experimentnumberI
if rand() <= hitI
   Ipoint = Ipoint+1;
end;
end;



%%

score(indexi) = Tpoint + Dpoint + Ipoint;

end;

if identi==2
result2(:,1)=score;
end;

if identi==3
result3(:,1)=score;
end;

if identi==4
result4(:,1)=score;
end;
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if identi==5
result5(:,1)=score;
end;

if identi==6
result6(:,1)=score;
end;

if identi==7
result7(:,1)=score;
end;

if identi==8
result8(:,1)=score;
end;

if identi==9
result9(:,1)=score;
end;

if identi==10
result10(:,1)=score;
end;

end;

%Saving the results
%This line should be modified according to the currently saved case.
save('TDI_1000_000_000_10.mat','result10','-v7.3')
%save('TDI_1000_000_000_9.mat','result9','-v7.3')
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%save('TDI_1000_000_000_8.mat','result8','-v7.3')
%save('TDI_1000_000_000_7.mat','result7','-v7.3')
%save('TDI_1000_000_000_6.mat','result6','-v7.3')
%save('TDI_1000_000_000_5.mat','result5','-v7.3')
%save('TDI_1000_000_000_4.mat','result4','-v7.3')
%save('TDI_1000_000_000_3.mat','result3','-v7.3')
%save('TDI_1000_000_000_2.mat','result2','-v7.3')
```