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%written by Shiv Kumar Gurjar (BT23ECE084)
%shanon-Fano coding
clc;
clear;
close all;
% Input symbols and probabilities
symbols = {'m1','m2','m3','m4','m5','m6','m7','m8'};

% Example probabilities (CHANGE THESE)
P = [0.22 0.18 0.15 0.12 0.10 0.09 0.08 0.06];

% Normalize (safety check)
P = P / sum(P);

% Sort symbols by descending probability
[P_sorted, idx] = sort(P, 'descend');
symbols_sorted = symbols(idx);

% Initialize codes
codes = repmat({''}, 1, length(P_sorted));

% Shannon-Fano recursive function
function codes = shannon_fano(P, symbols, prefix)
    if length(P) == 1
        codes = {prefix};
        return;
    end

    % Find partition with minimum probability difference
    total = sum(P);
    diff = inf;
    split = 1;

    for i = 1:length(P)-1
        d = abs(sum(P(1:i)) - sum(P(i+1:end)));
        if d < diff
            diff = d;
            split = i;
        end
    end

    % Recursive coding
    left = shannon_fano(P(1:split), symbols(1:split), [prefix '0']);
    right = shannon_fano(P(split+1:end), symbols(split+1:end), [prefix '1']);

    codes = [left right];
end

% Generate codes
codes_sorted = shannon_fano(P_sorted, symbols_sorted, '');

% Display results
disp('Shanon-Fano Coding');
disp('-----');
for i = 1:length(symbols_sorted)
    fprintf('%s P=%f Code=%s\n', ...

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    symbols_sorted{i}, P_sorted(i), codes_sorted{i});  
end
```

Shannon-Fano Coding

```
m1 P=0.220 Code=00  
m2 P=0.180 Code=010  
m3 P=0.150 Code=011  
m4 P=0.120 Code=100  
m5 P=0.100 Code=101  
m6 P=0.090 Code=110  
m7 P=0.080 Code=1110  
m8 P=0.060 Code=1111
```

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