M-Ary Shanon Fano Encoding

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Defaults

```
clear; clc;
```

Inputs

```
%probabs = input("Enter probabilites of symbols: ");
probabs = [0.1 0.2 0.1 0.3 0.1 0.1 0.1];
M = 2;
%M = input("Enter M = ");
N = length(probabs);

% Sort probabilities
[SortedProbabs, order] = sort(probabs, 'descend');

% Initialize codes
codes = repmat({''}, 1, N);
```

M-ary Shanon-Fano Algorithm

```
function codes = ShannonFano_Mary(probs, idx, codes, M)

    n = length(idx);

    % Base case: single symbol
    if n == 1
        return;
    end

    % Base case: n <= M → assign digits and stop
    if n <= M
        for i = 1:n
            codes{idx(i)} = [codes{idx(i)} num2str(i-1)];
        end
        return;
    end

    % -------- SPLITTING --------
    totalProb = sum(probs);
    target = totalProb / M;
```

```
    groups = cell(1, M);
    groupProbs = cell(1, M);

    g = 1;
    acc = 0;
    startIdx = 1;

    for i = 1:length(probs)
        acc = acc + probs(i);

        if acc >= target && g < M
            groups{g} = idx(startIdx:i);
            groupProbs{g} = probs(startIdx:i);
            startIdx = i + 1;
            acc = 0;
            g = g + 1;
        end
    end

    % Last group takes remaining symbols
    groups{g} = idx(startIdx:end);
    groupProbs{g} = probs(startIdx:end);

    % Append Digits
    for g = 1:length(groups)
        for i = groups{g}
            codes{i} = [codes{i} num2str(g-1)];
        end
    end

    % Recursion
    for g = 1:length(groups)
        codes = ShannonFano_Mary(groupProbs{g}, groups{g}, codes, M);
    end
end
```

```
Probabilities:
    0.1000    0.2000    0.1000    0.3000    0.1000    0.1000    0.1000

Shannon–Fano Codes:
    {'1000'}    {'01'}    {'1001'}    {'00'}    {'101'}    {'110'}    {'111'}
```

Results Viewing

```
codes = ShannonFano_Mary(SortedProbabs, order, codes, M);

% Display
disp('Probabilities:');
disp(probabs);
disp('Shannon–Fano Codes:');
disp(codes);
```

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