Arithmetic Encoding

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Input: Symbol set with probabilities and input sequence

Output: Encoded interval and representative fractional value

Defaults

```
clc;
clear all;
close all;
```

Inputs, Variables, Constants

```
charSet      = ["A", "B", "C", "D"];
charProb     = [0.1 0.4 0.2 0.3];
msgSequence  = 'BDACB';
```

Interactive Inputs

```
%charSet     = input("Enter symbol set in ascending order: ");
%charProb    = input("Enter corresponding probability values: ");
%msgSequence = input("Enter message sequence: ");
```

Algorithm

```
cumDist = [0 cumsum(charProb)];

lowVal  = 0;
highVal = 1;

fprintf('Initial range: [%.6f , %.6f)\n\n', lowVal, highVal);

for n = 1:length(msgSequence)
    pos = find(charSet == msgSequence(n));

    % Width of current interval
    width = highVal - lowVal;
```

```matlab
    % Compute new interval
    lowNext  = lowVal  + width * cumDist(pos);
    highNext = lowVal  + width * ...
              (cumDist(pos) + charProb(pos));

    % Update bounds
    lowVal  = lowNext;
    highVal = highNext;

    fprintf('After %c : [%.6f , %.6f)\n', ...
            msgSequence(n), lowVal, highVal);
end
```

Initial range: [0.000000 , 1.000000)

After B : [0.100000 , 0.500000)
After D : [0.380000 , 0.500000)
After A : [0.380000 , 0.392000)
After C : [0.386000 , 0.388400)
After B : [0.386240 , 0.387200)

Results

```matlab
fprintf('\nEncoded range for the message "%s" is: [%f , %f)\n', ...
        msgSequence, lowVal, highVal);

finalCode = (lowVal + highVal) / 2;
fprintf('Assigned average value for the message is: %f\n', finalCode);
```

Encoded range for the message "BDACB" is: [0.386240 , 0.387200)
Assigned average value for the message is: 0.386720

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