

SOLUTION

MENTAL ABILITY

Each of the operations B, R, A, I, N and S performs an operation on a string variable which comprises only of repeated characters from the word “ $BRAIN$ ”.

Alternatively (and perhaps much easier) is to interpret each variable as a 5-tuple of character counts (so “ $BRRAAIN$ ” is equivalent to $[1,2,3,1,1]$):

$B(x)$ - Converts the number of each character to its alphanumeric representation (1=A, 2=B, etc)

$R(x)$ - Removes one occurrence of the character(s) that occur the most frequently
(i.e. decrement every maximal element of the character count tuple by 1)

$A(x_1, x_2, \dots, x_n)$ - Concatenates input strings together (while preserving “ $BRAIN$ ” character ordering)
(i.e. add character count tuples together)

$I(x)$ - Replaces the number of $B, R, A, I,$ and N s with the number of $N, I, A, R,$ and B s respectively
(i.e. reverses the character count tuple)

$N(x)$ - Replaces the number of $B, R, A, I,$ and N s with the number of $R, A, I, N,$ and B s respectively
(i.e. left-shifts the character count tuple)

$S(x)$ - Removes a B and inserts 2 I s
(i.e. decrements the B -element of the character count tuple, and increases the I -element by 2)

Applying these operations (and in some cases solving for implied values) gives:

$$B = [0,0,0,0,1] = \text{“}N\text{”}$$

$$R = [1,1,3,3,0] = \text{“}BRAAIII\text{”}$$

$$A = [1,1,1,1,0] = \text{“}BRAI\text{”}$$

$$I = [3,4,4,4,1] = \text{“}BBRRRRRAAAIIIIIN\text{”}$$

$$N = [1,2,4,6,3] = \text{“}BRRAAAIIIIIINNN\text{”}$$

$$S = [12,16,16,16,4] = \underbrace{\text{“}BB\text{”}}_{12\ B_s} \dots \underbrace{\text{“}BRR\text{”}}_{16\ B_s} \dots \underbrace{\text{“}RAA\text{”}}_{16\ A_s} \dots \underbrace{\text{“}AII\text{”}}_{16\ I_s} \dots \text{“}INNN\text{”}$$

$$\text{ANSWER} = B(R(A(I(N), S))) = B([15,21,20,18,5]) = \text{OUTRE.}$$