# Solution of Problem 2

All Arabic words in the problem are made according to one of the patterns *1a2a3t*, *i12ā3*, *1u23* and *1u23ēn* (whereby words using the first and the second pattern always come together in this order and words using the other two patterns occur on their own). In these patterns *1-2-3* is one of the triples of consonants *r-b-ʕ*, *s-b-ʕ*, *s-d-s*, *t-l-t*, *t-m-n*, *t-s-ʕ*, *x-m-s*, *ʕ-š-r*. Let us assume that the consonant triples correspond to numbers between 1 and 10 and the arrangements of the vowels indicate certain functions, in particular, *1a2a3t i1′2′ā3′* is either $\frac{n}{n'}$ or $\frac{n'}{n}$ (and in either case *xamast ixmās* $= \frac{n}{n} = 1$), and *1u23* $= \frac{i}{n}$ and *1u23ēn* $= \frac{j}{n}$, for some as yet unknown i and j.

From equality (5) we see that *s-b-ʕ* and *x-m-s* are 5 and 7 (in one order or the other), and from $\frac{j}{5} + \frac{j}{7} = \frac{(7+5)j}{35} = \frac{24}{35}$ it follows that $j = 2$, that is, *1u23ēn* $= \frac{2}{n}$. Since *1u23* is shorter than *1u23ēn*, we can assume that this pattern corresponds to a more basic function, and the only candidate for such a one is $\frac{1}{n}$.

From(1) it follows that *t-l-t* is 3 (and that the numerator precedes the denominator in the Arabic fractions). From (4) we see that *t-m-n* is greater than *s-b-ʕ* by one. From (3) it follows that 3*s-d-s* = 2*t-s-ʕ*. Thus *t-s-ʕ* is divisible by three. Since the value 3 is already taken, *t-s-ʕ* and *s-d-s* are either 6 and 4 or 9 and 6, respectively, and *t-m-n*, *s-b-ʕ* and *x-m-s* are respectively 8, 7 and 5.

We have yet to use equality (2). Letting *s-d-s* be equal to 4 gets us nowhere ($\frac{7}{3} + \frac{1}{4} = \frac{31}{12}$ can't be reduced to a fraction with a numerator and denominator between 1 and 10), consequently *s-d-s* = 6, and $\frac{7}{3} + \frac{1}{6} = \frac{15}{6} = \frac{5}{2} = \frac{10}{4} =$ *ʕ-š-r*/*r-b-ʕ*. (The root *r-b-ʕ* '4' is the source of the word *ruba'i* 'quatrain', used also in English.)

**Assignment 1.** (1) $\frac{1}{8} + \frac{2}{8} = \frac{3}{8}$, (2) $\frac{7}{3} + \frac{1}{6} = \frac{10}{4}$, (3) $\frac{2}{9} + \frac{1}{9} = \frac{2}{6}$, (4) $\frac{5}{5} + \frac{1}{7} = \frac{8}{7}$, (5) $\frac{2}{7} + \frac{2}{5} = \frac{24}{35}$.

**Assignment 2.** *rubʕ + ʕašart itsāʕ* $= \frac{1}{4} + \frac{10}{9} = \frac{49}{36}$ and *sabaʕt isdās* $= \frac{7}{6}$. Thus either $\sqrt{\textit{rubʕ} + \textit{ʕašart itsāʕ}} = \textit{sabaʕt isdās}$ or, perhaps, *rubʕ* + *ʕašart itsāʕ* = (*sabaʕt isdās*)$^2$ (if we don't consider brackets to be a sign).