different from those produced earlier? To answer this question, we first note that $(k_i)^2 = 1$ and $(v_i)^2 = 1$ for all $1 \le i \le N_0$, whereas $k_i \cdot v_i$ is either 1 or -1 with $k_i \cdot v_i = 1$ when $k_i = 1$ and $v_i = 1$ (that is, in r cases) and when $k_i = -1$ and $v_i = -1$ (that is, in d cases), and $k_i \cdot v_i = -1$ when $k_i = 1$ and $v_i = -1$ (that is, in b cases) and when $k_i = -1$ and $v_i = 1$ (that is, in l cases). In addition, $|k_i - v_i| = 2$ and $(k_i - v_i)^2 = 4$, when $k_i = 1$, and $v_i = -1$ (that is, in b cases) and when $k_i = -1$, whereas $v_i = 1$ (that is, in l cases), and in the other cases $|k_i - v_i| = 0$ and $(k_i - v_i)^2 = 0$. With this in mind we get the following:

$$\cos\phi_{KV} = \frac{\sum_{i=1}^{N_0} k_i \cdot v_i}{\sqrt{\sum_{i=1}^{N_0}(k_i)^2} \cdot \sqrt{\sum_{i=1}^{N_0}(v_i)^2}} = \frac{r + d - b - l}{\sqrt{N_0} \cdot \sqrt{N_0}}$$

$$= \frac{r + d - (N_0 - r - d)}{N_0} = \frac{2(r + d)}{N_0} - 1 = 2\left(\frac{r}{N_0} + \frac{d}{N_0}\right) - 1$$

$$= 2\left(\frac{r \cdot C}{C \cdot N_0} + \frac{d \cdot L}{L \cdot N_0}\right) - 1 = 2\left(R \cdot P_0 + S \cdot \frac{N_0 - C}{N_0}\right) - 1$$

$$= 2[R \cdot P_0 + S(1 - P_0)] - 1;$$

$$\rho(K, V) = \sum_{i=1}^{N_0} |k_i - v_i| = 2(b + l) = 2(C + N - 2r);$$

$$\rho_1(K, V) = \sqrt{\sum_{i=1}^{N_0}(k_i - v_i)^2} = \sqrt{4(b + l)} = 2\sqrt{C + N - 2r};$$

$$\gamma(K, V) = \frac{\sum_{i=1}^{N_0} k_i \cdot v_i}{\sum_{i=1}^{N_0}(k_i)^2 + \sum_{i=1}^{N_0}(v_i)^2 - \sum_{i=1}^{N_0} k_i \cdot v_i} = \frac{r + d - b - l}{N_0 + N_0 - r - d + b + l}$$

$$= \frac{\dfrac{r + d - b - l}{N_0}}{2 - \dfrac{r + d - b - l}{N_0}} = \frac{2[R \cdot P_0 + S(1 - P_0)] - 1}{2 - 2[R \cdot P_0 + S(1 - P_0)] + 1}$$

$$= \frac{2[R \cdot P_0 + S(1 - P_0)] - 1}{3 - 2[R \cdot P_0 + S(1 - P_0)]}.$$

It follows from the obtained expressions of the complex search characteristics that, from the point of view of using these characteristics to evaluate search

results, they are equivalent to some of the CSCs that were constructed with the help of binary scales employed earlier (for defining k_i and v_i). At the same time, the set of newly produced CSCs is substantially different from the set of characteristics previously produced. This means that it might be promising to consider other binary scales in defining k_i and v_i to produce new CSCs. However, we will not dwell on this problem here, though we will note that, generally speaking, larger-sized scales can be used instead of binary scales to construct complex search characteristics. This aspect of basic models modification deserves special discussion and will be considered in the subsequent section of this chapter.

One more source for CSC stock replenishment is the models that are similar to the ones discussed earlier but that are based on other vectors. For example, let us assume that vector $U = (R, P)$ is constructed from the achieved levels of recall and precision of search, and that vector $E = (1, 1)$ is introduced for discussion. The use of functions allowing evaluation of closeness of these vectors will lead, in particular, to the following complex search characteristics:

$$I_7 = \rho(E, U) = |1 - R| + |1 - P| = 2 - R - P,$$

$$I_8 = \rho_1(E, U) = \sqrt{(1 - R)^2 + (1 - P)^2}.$$

From the point of view of search result evaluation, characteristic I_7 is equivalent to characteristic $I_1 = R + P$, whereas characteristic I_8 should probably be included in the set of new CSCs.

To conclude the discussion of the proposed types of models, we will emphasize the accuracy of using functions allowing one to evaluate the closeness of vectors. For example, in the case of vectors E and U, one should not use the function $\cos\phi_{EU}$ to construct a complex search characteristic. Indeed,

$$\cos\phi_{EU} = \frac{\sum_{i=1}^{2} e_i \cdot u_i}{\sqrt{\sum_{i=1}^{2}(e_i)^2} \cdot \sqrt{\sum_{i=1}^{2}(u_i)^2}} = \frac{R + P}{\sqrt{2} \cdot \sqrt{R^2 + P^2}}.$$

It follows from this that with any $R = P \neq 0$, $\cos\phi_{EU} = 2R/(\sqrt{2} \cdot \sqrt{2R^2}) = 1$. In other words, if complex search characteristic $(R + P)/(\sqrt{2} \cdot \sqrt{R^2 + P^2})$ is employed to evaluate search results, it will be found that (for example, in the case of the search resulting in $R = 0.5$ and $P = 0.5$ and in the case of the search resulting in $R = 1$ and $P = 1$) the output quality would be seen as equal, which is clearly absurd. Similar examples can be provided for a situation with $R \neq P$.

Thus, in the case of vectors E and U, their closeness cannot be correctly determined by the angle between them. At the same time, it follows from the way vectors K and V are constructed that if the described binary scales are used to determine k_i and v_i, it seems justified that the closeness of vectors K and V