Solutions

Ans1: Distance function can only be proper function if it follows the following conditions:

i) $d(x,y) \geq 0 \;\&\; d(x,y) = 0 \;\; if(x == y)$
ii) $d(x,y) = d(y,x)$

Distance between two places can't be negative,

$$A: d(x,y)\; for\; (0,0,0)\;\&\;(0,1,0) = (0-0)^2 + (0-1)^2 + (0-0)^2 = 1$$

$$B: d(y,x)\; for\; (0,0,0)\;\&\;(0,1,0) = (0-0)^2 + (1-0)^2 + (0-0)^2 = 1$$

Therefore, $A = B$

Since this result didn't violates any of the above two conditions.

The distance between $x(0,0,0)$ and $y(0,1,0)$ by proper distance formula:

$$d(x,y) = \sqrt{((0-0)^2 + (0-1)^2 + (0-0)^2)} = 1$$

Hence, the given function $d(x,y) = \Sigma((x_i - y_i)^2)$ is a proper function.

Ans2: Let event of an employee travelling to England be E,

And event of an employee travelling to Italy be I,

And event of an employee travelling to Spain be S,

And event of getting Covid be C.

$$P(E) = 0.5$$

$$P(I) = 0.2$$

$$P(S) = 0.3$$

$$P(C|E) = 0.0012$$

$$P(C|I) = 0.0014$$

$$P(C|S) = 0.0018$$

Therefore, $P(C) = P(C|E) \times P(E) + P(C|I) \times P(I) + P(C|S) \times P(S)$

$$= 0.0012 \times 0.5 + 0.0014 \times 0.2 + 0.0018 \times 0.3 = 0.00142 = 0.142\%$$

Now to find probability of travelling to England given Covid has been contracted,

$$P(E|C) = \frac{P(C|E) \times P(E)}{P(C)} = \frac{(0.0012 \times 0.5)}{0.00142} = \frac{0.0006}{0.00142} = 0.4225 = 42.25\%$$