1)

$$g_1 = f_1 + h_2 * f_2$$
$$g_2 = h_1 * f_1 + f_2$$

Take Fourier transforms on both sides

note ($a * b \xrightarrow{F} A.B$)

$$\therefore \quad G_1(M) = F_1(M) + H_2(M).F_2(M)$$
$$G_2(M) = H_1(M)F_1(M) + F_2(M)$$

Solve for $F_1(M)$ & $F_2(M)$

$$\Rightarrow \quad F_1(M) = \frac{G_1(M) - H_2(M)G_2(M)}{1 - H_1(M)H_2(M)}$$

$$F_2(M) = \frac{G_2(M) - H_1(M)G_1(M)}{1 - H_1(M)H_2(M)}$$

Here $F_1, F_2, G_1, G_2, H_1, H_2$ are the fourier transforms of $f_1, f_2, g_1, g_2, h_1, h_2$.

$\therefore$ Now knowing ~~the~~ g_1, g_2, h_1, h_2, we can find out F_1 & F_2 & then by taking their IFT, we get f_1 & f_2.

The inherent problem here is that $F_1(M)$ & $F_2(M)$ are undefined when ~~$H_1(M) = H$~~ $H_1(M).H_2(M) = 1$ as the denominator becomes zero.

Also, h_1 & $h_2 \longrightarrow$ low pass filter kernels & $\int_{-\infty}^{\infty} h_i(x)dx = 1$ for $i = 1, 2$.

$$\therefore \quad H_1(0) = \int_{-\infty}^{\infty} h(x)e^{-j0x}dx = \int_{-\infty}^{\infty} h_1(x)dx = 1$$

Similarly $H_2(0) = 1$

$\therefore$ At $M = 0$, $H_1(0) = H_2(0) = 1$ & $F_1(M)$ & $F_2(M)$ become undefined.

$\therefore$ At lower frequencies when $H_1(M)H_2(M) = 1$, reconstruction is not possible, while at higher frequencies ~~as~~ it is possible as $H_1(M)$ & $H_2(M) \downarrow$ on $\uparrow M$ as they are ~~high~~ low pass filters and so $H_1(M)H_2(M) \neq 1$ any longer & the solutions exists.