Q1)

As $g_1 = f_1 + h_2 * f_2$

$g_2 = h_1 * f_1 + f_2$

Applying Fourier transform

$$G_1 = F_1 + H_2 \cdot F_2$$

$$G_2 = F_2 + H_1 \cdot F_1$$

Solving these linear equations we get

$$F_1 = \frac{G_1 - H_2 G_2}{1 - H_1 H_2} \quad \text{when } H_1 H_2 \neq 1$$
$$c_1(u,v) \text{ otherwise}$$

$$F_2 = \frac{G_2 - H_1 G_1}{1 - H_1 H_2} \quad \text{when } H_1 H_2 \neq 1$$
$$c_2(u,v) \text{ otherwise.}$$

$$\therefore \quad f_1 = IFT\left(\frac{G_1 - H_2 G_2}{1 - H_1 H_2}\right)$$

$$f_2 = IFT\left(\frac{G_2 - H_1 G_1}{1 - H_1 H_2}\right)$$

→ The problem here is we donot know $F_1(u,v)$ & $F_2(u,v)$ when $1 - H_1(u,v) \cdot H_2(u,v) = 0$

→ So, the above derived result is an approximation to f_1 & f_2 as some frequency components are not known, and we are just guessing c_1 & c_2

→ The result may enhance if

$$c_1(u,v) = \lim_{(u_1,v_1) \to (u,v)} \frac{G_1(u_1,v_1) - H_2(u_1,v_1)\, G_2(u_1,v_1)}{1 - H_1(u_1,v_1)\, H_2(u_1,v_1)}$$

$$\& \quad c_2(u,v) = \lim_{(u_2,v_2) \to (u,v)} \frac{G_2(u_2,v_2) - H_1(u_2,v_2)\, G_1(u_2,v_2)}{1 - H_2(u_2,v_2)\, H_1(u_2,v_2)}$$