[3.]

$$f(u) = (1-u)^3 p_0 + 3u(1-u)^2 p_1 + 3u^2(1-u) p_2 + u^3 p_3$$

$$p_0 = (1-u) s_0 + u s_1$$

$$= (1-u)\left((1-u) r_0 + u r_1\right) + u\left((1-u) r_1 + u r_2\right)$$

$$= (1-u)\left[(1-u)\left[(1-u) p_0 + u p_1\right] + u\left[(1-u) p_1 + u p_2\right]\right] + u\left[(1-u)\left[(1-u) p_1 + u p_2\right] + u\left[(1-u) p_2 + u p_3\right]\right]$$

$$= (1-u)^3 p_0 + \underline{u(1-u)^2 p_1} + \underline{u(1-u)^2 p_1} + u^2(1-u) p_2 + \underline{u(1-u)^2 p_1} + u^2(1-u) p_2 + u^2(1-u) p_2 + u^3 p_3$$

$$= (1-u)^3 p_0 + 3u(1-u)^2 p_1 + 3u^2(1-u) p_2 + u^3 p_3 = f(u)$$

□