(5)

Q2] $X_1 \sim Exp(2)$, $X_2 \sim Exp(5)$

$F_{X_1}(x_1) = 1 - e^{-x_1/2}$, $x_1 > 0$, $F_{X_2}(x_2) = 1 - e^{-x_2/5}$, $x_2 > 0$

$G_{Y_2}(y_2) = F_{X_1}(y_2) F_{X_2}(y_2) = (1 - e^{-y_2/2})(1 - e^{-y_2/5})$, $y_2 > 0$

$g_{Y_2}(y_2) = \frac{d}{dy_2} G(y_2) = \frac{1}{2} e^{-y_2/2}(1 - e^{-y_2/5}) + \frac{1}{5} e^{-y_2/5}(1 - e^{-y_2/2})$, $y_2 > 0$

$P(Y_2 < 10) = \int_0^{10} g(y_2)\, dy_2 = 1 + e^{-7} - e^{-5} - e^{-2}$

$= 0.858839$

OR] $P(Y_2 < 10) = G_{Y_2}(10) = (1 - e^{-5})(1 - e^{-2})$

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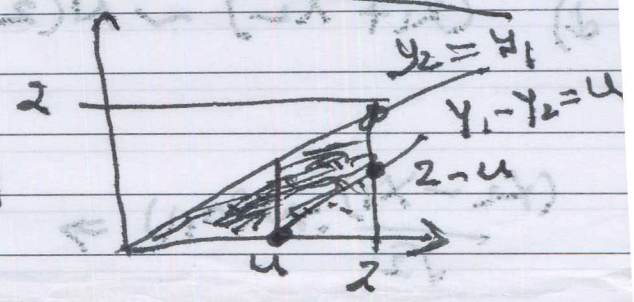
(10)

Q3] $0 \le u \le 2$

$G(u) = P(U \le u) = P(Y_1 - Y_2 \le u)$

$= P(Y_2 \ge Y_1 - u)$



$y_2 = y_1 - u$

(I) $= \int_0^{2-u} \int_{y_2}^{u+y_2} \frac{1}{4} y_1^2\, dy_1\, dy_2 + \int_{2-u}^{2} \int_{y_2}^{2} \frac{1}{4} y_1^2\, dy_1\, dy_2$

$= \frac{1}{48} u^2 (24 - 8u + u^2) - \frac{u}{24}(-16 + 12u - 4u^2 + u^3)$

(II) $= \int_0^{u} \int_{0}^{y_1} \frac{y_1^2}{4}\, dy_2\, dy_1 + \int_{u}^{2} \int_{y_1 - u}^{y_1} \frac{y_1^2}{4}\, dy_2\, dy_1$

$= \frac{2u}{3} - \frac{u^4}{48}$, $0 \le u \le 2$

(III) $1 - \int_0^{2-u} \int_{y_2+u}^{2} \frac{y_1^2}{4}\, dy_1\, dy_2 = 1 + \frac{1}{48}(-48 + 32u - u^4)$

(IV) $1 - \int_u^{2} \int_{0}^{y_1 - u} \frac{y_1^2}{4}\, dy_2\, dy_1 = \frac{2u}{3} - \frac{u^4}{48}$, $0 \le u \le 2$

$\rightarrow g(u) = \frac{2}{3} - \frac{u^3}{12}$, $0 \le u \le 2$