

IMM - DTU

02405 Probability  
2003-11-12  
BFN/bfn

Question a)

$$P(U_{(1)} \geq x, U_{(n)} \leq y)$$

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Question a)

$$P(U_{(1)} \geq x, U_{(n)} \leq y) = P(x \leq U_1 \leq y, x \leq U_2 \leq y, \dots, x \leq U_n \leq y) = (y-x)^n$$

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Question b)

$$P(U_{(1)} \geq x, U_{(n)} > y)$$

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$$P(U_{(1)} \geq x, U_{(n)} > y) = P(U_{(1)} \geq x) - P(U_{(1)} \geq x, U_{(n)} \leq y)$$

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$$P(U_{(1)} \geq x, U_{(n)} > y) = P(U_{(1)} \geq x) - P(U_{(1)} \geq x, U_{(n)} \leq y) = (1-x)^n - (y-x)^n$$

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Question c)

$$P(U_{(1)} \leq x, U_{(n)} \leq y)$$

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Question d)

$$1 - (1-x)^n - y^n + (y-x)^n$$

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Question e)

$$P(U_{(k)} \leq x, y < U_{(k+1)})$$

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$$P(U_{(k)} \leq x, y < U_{(k+1)}) = \binom{n}{k} x^k (1-y)^{n-k}$$

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Question f)

$$P(U_{(k+1)} \leq x, y < U_{(k+2)}) + P(U_{(k)} \leq x, x < U_{(k+1)} \leq y, y < U_{(k+2)}) + P(U_{(k)} \leq x, y < U_{(k+1)})$$

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$$P(U_{(k)} \leq x, y < U_{(k+1)}) = \binom{n}{k} x^k (1-y)^{n-k}$$

Question f)

$$\begin{aligned} &P(U_{(k+1)} \leq x, y < U_{(k+2)}) + P(U_{(k)} \leq x, x < U_{(k+1)} \leq y, y < U_{(k+2)}) + P(U_{(k)} \leq x, y < U_{(k+1)}) \\ &= \binom{n}{k+1} x^{k+1} (1-y)^{n-k-1} + \frac{n!}{k!1!(n-k-1)!} x^k (y-x) (1-y)^{n-k-1} + \binom{n}{k} x^k (1-y)^{n-k} \end{aligned}$$