Categories – Solutions

Name that Continuous Distribution	Rules for Expectations	Convergence Related	Name that Discrete Distribution	Xforms of All Types
100 Bivariate Normal	100 $36V(X) + 4Var(Y) = 104$	100 Conv. in Dist.	100 Poisson	100 NB(4, .7) by mgfs
200 Beta	200 $E(X) = 4E(Y) + 9 = 25$ $SD(X) = \sqrt{16 Var(Y)} = 12$	200 $\mu = E(X)$	200 NB (Geo for 1 that $\Rightarrow$ NB for 5)	200 CDFs / 1-D Xform b/c 1-1
300 Gamma or Exp	300 DD No. $E(Y) = 2$	300 $\mu = E(X) = 6$ by WLLN	300 Hypergeometric	300 2-D Xform (indirectly in conditioning)
400 Normal	400 ☆	400 $Y = \frac{X-6}{\sqrt{6}} \sim N(0,1)$	400 Multinomial	400 Mgf, conditioning 2D Xform
500 Exponential	500 ☆	500 $\bar{X} \sim N(\mu, \frac{\sigma}{\sqrt{60}})$ by CLT	500 Binomial	500 The determinant is jacobian (matrix is Hessian).

☆ = see longer solution sheet

Double Categories – Solutions

Standardization Fun	Pesky Integrals	Probability Basics	Anything Conditional	Random
200 Z-score $P(Z > \frac{16-12}{4}) = P(Z > 1)$	200 $\int_6^{\infty}\int_5^{x} f(x,y)\,dy\,dx$	200 $P(S)=1 \quad P(A)\geq 0$ $P(\text{union m.e. events}) = \sum P(\text{events})$	200 $f_X(x)$ marginal of x	200 reducible
400 Normal $\approx$ to Bin. use CC	400 $\int_0^3\int_y^6 f(x,y)\,dx\,dy$	400 $\binom{10}{2}$	400 $E(X) = E(E(X\|Y))$ $= E(Y) = \frac{4+0}{2} = 2$	400 Tchebysheff's Theorem
600 CC!	600 $\int_0^{\infty}\int_0^{\frac{1}{2}x} f(x,y)\,dy\,dx$	600 $26\cdot 25\cdot 24\cdot 23\cdot 10\cdot 9$	600 smoothing! $V(X) = E(V(X\|Y)) + V(E(X\|Y))$	600 Geometric
800 ☆	800 $\int_0^{\infty}\int_0^{x} x\, f(x,y)\,dy\,dx$	800 Bayes rule	800 assume all = chance released $P(C) = \frac{2}{3} \quad P(O\|A) = \frac{1}{2}$	800 Normal
1000 $np,\ n(1-p) \geq 10$ $\lambda > 25$	1000 $\int_0^{\infty}\int_0^{x} xy\, f(x,y)\,dy\,dx$	1000 predictive value	1000 $f_{X,Y} = f_X \cdot f_{Y\|X}$	1000 Stochastic process

↑ other answers can swap dy/dx order if bounds change too!

Longer Calculation Answers (*)

Rules for Exp.

400 $E(X) = E(Y^2) - 6E(Y) + 3$

$= V(Y) + [E(Y)]^2 - 6E(Y) + 3$

$= -4$

Not enough for SD(x).

500 $Cov = .5\sqrt{60} = \sqrt{15}$

$Var(2X - Y) = 4\,Var(X) + Var(Y) - 4\,Cov(X,Y)$

$= 46 - 4\sqrt{15}$

Standard deviation Fun (800 though it says 200)

$\bar{X} \sim N\left(20, \frac{2}{\sqrt{36}} = \frac{1}{3}\right)$

$P\left(Z < \frac{19-20}{1/3}\right) = P(Z < -3)$