ST 2054, 3068, 6003.

ST2054, ST3068, Finish 9 questions out of 10

ST 6003, $\underbrace{\text{2 compulsory questions}}_{\text{From Supratik's}}$ and $\underbrace{\text{Choose 7 out of rest 8.}}_{\text{From Liang's.}}$

Start with notes, assignments, tutorials and past exam papers.

Less bookwork typed questions

- Axioms of prob, prob of events, union, intersection,
- conditional prob, prob. of indep. events.
- Prob. mass f^n, prob. density f^n, conditional density f^n, marginal density.
- Typical discrete dist^n's: Poi, Geo, Bin, Neg. Bin,

  " " " : Normal, exp, etc.

  Know how to identify a particular dist^n given, MGF, pdf,

- Chebyshev, convergence in prob., Continuity Theorem.

  Note: no more bookwork question for this material

- Expectation, Variance, (conditional),

  Be able to find $E[X|Y]$ given certain marginal or joint density.

- PCA. Be able to calculate the co-variance matrix given two vectors, and carry out the PCA.

- Moment generating f^n., MGF of compound $dist^n$; MGF of joint $dist^n$,
- Biased and unbiased estimator, sampling variance/mean, sampling moments.
- Jacobian (of Joint $Dist^n$.), non-linear transform of a Random vector, e.g. polar system.
- CIs, Hypothesis testing, ANOVA

(iii) $P[X>0, Y>0] = P[w>0\ ,\ z> -\frac{w\rho}{\sqrt{1-\rho^2}}]$,

convert to polar coordinates.

Recall: $\iint_R f(x,y)\,dx\,dy = \iint_R f(r\cos\theta, r\sin\theta)\, r\,dr\,d\theta$.

let $z = r\sin\theta$. $\quad w^2+z^2 = r^2 > w^2 + \frac{w^2\rho^2}{1-\rho^2} = w^2\left(\frac{1+\rho^2}{1-\rho^2}\right) > 0$.

$w = r\cos\theta$,

$\Rightarrow r>0$

$\because z > -\frac{w\rho}{\sqrt{1-\rho^2}} \qquad \frac{z}{w} > -\frac{\rho}{\sqrt{1-\rho^2}} \qquad \tan\theta > -\frac{\rho}{\sqrt{1-\rho^2}}$

$\theta > \tan^{-1}\left(-\frac{\rho}{\sqrt{1-\rho^2}}\right) = -\tan^{-1}\left(\frac{\rho}{\sqrt{1-\rho^2}}\right) = -\sin^{-1}(\rho)$

$\Rightarrow P[w>0\ ,\ z> -\frac{w\rho}{\sqrt{1-\rho^2}}] = \int_0^\infty \int_{-\frac{w\rho}{\sqrt{1-\rho^2}}}^{\infty} \frac{1}{2\pi} e^{-\frac{1}{2}(w^2+z^2)}\, dz\,dw$

$= \int_{-\sin^{-1}(\rho)}^{\frac{1}{2}\pi} \int_{r=0}^{\infty} \frac{1}{2\pi} e^{-\frac{1}{2}r^2}\, r\,dr\,d\theta = \int_{-\sin^{-1}(\rho)}^{\frac{1}{2}\pi} \frac{1}{2\pi}\, d\theta$

$= \frac{1}{2\pi}\theta \Big|_{\alpha}^{\frac{\pi}{2}} = \frac{1}{4} + \frac{1}{2\pi}\sin^{-1}\rho$