# MATH 170A Final

## John Arthur Minhquan Dang

**TOTAL POINTS** 

## 89 / 100

**QUESTION 1** 

## Question 1<sub>10 pts</sub>

1.1 (a) 5 / 5

√ + 2 pts Recalls PDF of exponential distribution

√ + 2 pts Sets up integral correctly

√ + 1 pts Evaluates integral correctly

1.2 (b) 5 / 5

√ + 2 pts Knows formula for variance

√ + 2 pts Sets up integral(s) correctly

√ + 1 pts Evaluates correctly

+ 1 pts Just states the value of Var[X], with no other work. (Mutually exclusive with other points).

QUESTION 2

## Question 2 10 pts

2.1 (a) 4 / 5

- 0 pts Correct

√ - 1 pts Forgets '0 otherwise'

- 1 pts Error in computing X mod 3

- 1 pts Other small computational error

- 3 pts Structural error

- 5 pts Blank / no answer

2.2 (b) 5/5

- 0 pts Correct

√ - 0 pts Forgot '0 otherwise', but had already lost points for this in part (a)

- 1 pts Forgot '0 otherwise', had NOT already lost points for this in part (a)

- 1 pts Error in computing 5 mod (X + 1)

- 1 pts Other small computational error

- 3 pts Structural error

- **5 pts** Blank / no answer

**QUESTION 3** 

## Question 3 15 pts

3.1 (a) 3 / 3

√ + 3 pts Correct

+ 2 pts Small mistake

+ 1 pts No significant progress towards a solution / solution with major structural problems

+ 0 pts Blank / no answer

3.2 (b) 2.5 / 3

- 0 pts Correct

 $\sqrt{-0.5}$  pts Forgets values outside of [0, 2] (should be zero for r < 0 and one for r > 2).

- 1 pts Sets up integral but is unable to proceed.

(Switching to polar makes the integral simple).

- 1 pts Computation error

- 2 pts Not correct

- 3 pts Blank/no answer

#### 3.3 (C) 3 / 3

√ - 0 pts Correct

- 0 pts Incorrect, but consistent from part (b)

- 0.5 pts Forgets '0 otherwise' / domain issues

- 1 pts Incorrect, but knows that the PDF is the

derivative of the CDF

- 2 pts Incorrect

- 3 pts Blank / no answer

3.4 (d) 3 / 3

√ - 0 pts Correct

- 0 pts Incorrect, but consistent from (c) and/or (b)

- 1 pts Incorrect, but knows how to find the

expected value from the PDF or CDF

- 2 pts Incorrect

- 3 pts Blank / no answer

3.5 (e) 2.5 / 3

- 0 pts Correct

 $\sqrt{-0.5}$  pts Domain issues (need zero outside the interval [-sqrt(3), sqrt(3)]

- 1 pts Computation mistake

- 2 pts Incorrect, but some correct statement

- 3 pts Blank / no answer

**QUESTION 4** 

4 Question 4 6 / 6

√ + 6 pts Correct

+ 1 pts Writes PMF of Poisson

+ 2 pts Writes definition of expected value

+ 0 pts Blank / no answer

**QUESTION 5** 

5 Question 5 2/7

+ 7 pts Correct

 $\checkmark$  + 2 pts Says that E[X\_1 + ... + X\_N] = E[X\_1] + ... + E[X\_N]. This is not correct; the left-hand side is a number and the right-hand side is a random variable... (The addition of expectation does not and

should not be expected to work for a random number of terms). Or, says that  $X_1 + ... + X_N$  is NX\_1. This is the opposite of iid. Also, it doesn't make sense to write NE[X\_1] = E[X\_1N] ... one of these is a RV, and the other a number. Also, it should be pointed out that expectations sum even if the

+ 1 pts No significant progress towards a solution.

+ 0 pts Blank/no answer

random variables are not independent.

QUESTION 6

Question 6 10 pts

6.1 (a) 5 / 5

√ - 0 pts Correct

- 1 pts Computational mistake

- 2 pts Does not take into account that there are 100 employees (and so finds - correctly - the probability that one employee is between 70k and 80k)

- 3 pts Incorrect, some correct ideas

- 5 pts Blank / no answer

6.2 (b) 5/5

√ - 0 pts Correct

- 1 pts Error in computing standard deviation of average (it is 500)

- 1 pts Error in using normal table

- **3 pts** Incorrect, recognizes normal distribution of average

4 pts Incorrect, no substantial progress towards a solution

- 5 pts Blank / no answer

**QUESTION 7** 

7 Question 7 **7** / **7** 

√ + 7 pts Correct

+ **0 pts** Incorrect

+ 1 pts LoTE for E[X]

+ 3 pts LoTE for E[XIT\_1]

+ 3 pts LoTE for E[XIH\_1]

**QUESTION 8** 

Question 8 10 pts

8.1 (a) 4 / 4

√ + 4 pts Correct

+ 0 pts Incorrect

8.2 (b) 3/3

√ + 3 pts Correct

+ 0 pts Incorrect

8.3 (C) 3/3

√ + 3 pts Correct

+ 0 pts Incorrect

QUESTION 9

9 Question 9 4 / 6

√ + 6 pts Correct

+ 0 pts Incorrect

- 2 Point adjustment

9

Should have had two integrals and broken integral up around c for dx.

#### QUESTION 10

## 10 Question 10 4 / 6

- √ + 6 pts Correct
  - + 0 pts Incorrect
- 2 Point adjustment
  - P(X^2 + Y^2 >=1) =/= 1 P(-1 <= X <= 1)P(-1 <= Y <= 1)</p>

#### **QUESTION 11**

### 11 Question 11 7 / 7

- √ + 7 pts Correct
  - + **0 pts** Incorrect

#### **QUESTION 12**

### 12 Question 12 6 / 6

- √ + 6 pts Correct
  - + 0 pts Incorrect

Answer the questions in the spaces provided. If you are using pencil, please write as darkly as possible. Explain your answers clearly - if the answer requires computation, write it down. Unless otherwise noted, please simplify. No phones or calculators are allowed. Only 2 pages (front and back) of notes are allowed. Sign your name below - by doing so you are agreeing to abide by the UCLA Student Code of Conduct.

Name: John Arthur Dang
Student ID Number:
Signature: Am Omy

Table 1: Table of the Standard Normal Cumulative Distribution Function  $\Phi(z)$ 

1.0,0035	2	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
1.3.2											
1.0007											
1.00											
2.8											
1.00   1.00											
1.7											
1.6											
2.4   0.0092   0.0096											
2.4											
1.2.1											0.0064
						0.0096					
-2.0		0.0139	0.0136			0.0125					
1.9		0.0228									
1.8		3.0287									
1.6											
-1.5         0.0668S         0.0651S         0.0643         0.0680S         0.0794         0.0733         0.0791         0.0733         0.0791         0.0733         0.0791         0.0763         0.0763         0.0793         0.0763         0.0793         0.0764         0.0733         0.0763         0.0669         0.0653         0.0838         0.0831           1.2         0.1151         0.1131         0.1112         0.1131         0.1112         0.1130         0.1020         0.0013         0.1020         0.0103         0.0010         0.0035         0.1020         0.0013         0.0031         0.0030         0.0035         0.1130         0.1121         0.1130         0.0121         0.0130         0.0095         0.1170         0.1170         0.1170         0.1170         0.0120         0.1170         0.1170         0.0120         0.1170         0.1230         0.1110         0.1120         0.1110         0.1110         0.1110         0.1120         0.1110         0.1120         0.1130         0.1170         0.1170         0.1140         0.1120         0.1170         0.1170         0.1170         0.1170         0.1130         0.1120         0.1120         0.1120         0.1120         0.1120         0.1120         0.1120         0.1120											
1.4											
1.1											
-1.1         0.1151         0.1112         0.1093         0.1075         0.1086         0.1020         0.1020         0.1090         0.985           -1.1         0.1575         0.1535         0.1519         0.1292         0.1271         0.1216         0.1210         0.1190         0.1790         0.1379           0.9         0.1587         0.1562         0.1539         0.1515         0.1469         0.1446         0.14486         0.1433         0.1401         0.1379           0.9         0.1587         0.1516         0.1780         0.1731         0.1566         0.1866         0.1866         0.1866         0.1866         0.1866         0.1867         0.1848         0.1871         0.2574         0.2243         0.2298         0.2256         0.2266         0.2286         0.2246         0.2217         0.2246         0.2246         0.2246         0.2246         0.2246         0.2284         0.2541         0.2577         0.2843         0.2439         0.3372         0.2666         0.2892         0.2480         0.3282         0.3166         0.3277         0.3669         0.3524         0.3528         0.3183         0.3745         0.3707         0.3669         0.3564         0.3594         0.3557         0.3520         0.3628 </th <th></th>											
1.1									0.1020		
-1.0											
-0.8         0.2119         0.2090         0.2061         0.2033         0.2006         0.1977         0.1849         9.1922         0.1894         0.1867           -0.7         0.2420         0.2358         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2261         0.2481         0.2481         0.2481         0.2481         0.2481         0.2481         0.2481         0.2461         0.2481         0.3832         0.3192         0.3186         0.3502         0.3527         0.3183         0.3481         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881         0.3881	-1.0		0.1562			0.1492		0.1446	0.1423	0.1401	0.1379
-0.7         0.24(20)         0.2388         0.2358         0.2358         0.2358         0.2358         0.2358         0.2358         0.2246         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2266         0.2286         0.2483         0.2441           -0.5         0.3050         0.3050         0.3024         0.3282         0.3192         0.3282         0.3192         0.3196         0.3267         0.3560         0.3282         0.3594         0.3596         0.3592         0.3594         0.3596         0.3592         0.3594         0.3596         0.3592         0.3594         0.3596         0.3592         0.3594         0.3596         0.3592         0.3594         0.3596         0.3592         0.3587         0.3520         0.3483           0.1         0.4602         0.4562         0.4483         0.4443         0.4404         0.4492         0.4893         0.4444         0.4494         0.4492         0.4891         0.4890         0.4562         0.4562         0.4562         0.4880         0.4404         0.4891         0.4891         0.4891         0.4891         0.4891         0.4891         0.4444         0.4424 <t< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></t<>											
-0.6         0.2743         0.2709         0.2676         0.2841         0.2841         0.2481         0.2481         0.2481         0.2481         0.2481         0.2481         0.2481         0.2481         0.2481         0.2481         0.2776         0.244         0.3448         0.3349         0.3372         0.3306         0.3500         0.3228         0.3192         0.3135         0.3707         0.3669         0.3622         0.3592         0.3192         0.3523         0.3352         0.3352         0.3352         0.3352         0.3352         0.3352         0.3352         0.3523         0.3352         0.3352         0.3552         0.3523         0.3352         0.3352         0.3523         0.3352         0.3352         0.3352         0.3552         0.3523         0.3396         0.3689         0.4484         0.4444         0.4444         0.4464         0.4661         0.6565         0.6666         0.6512         0.5120         0.5199 <th></th> <th>0.1867</th>											0.1867
-0.5         0.3085         0.3050         0.3015         0.2981         0.2946         0.2912         0.2877         0.2843         0.2310         0.2776           0.4         0.3448         0.3409         0.3376         0.3300         0.3300         0.3524         0.3557         0.3156         0.3712           0.3         0.3821         0.3788         0.3745         0.3707         0.3669         0.3682         0.3594         0.3557         0.3520         0.3837           0.1         0.4070         0.4166         0.4129         0.4052         0.4031         0.3843         0.3483           0.0         0.4000         0.4662         0.4522         0.4483         0.4444         0.4404         0.4364         0.4425         0.4225         0.4247           0.0         0.5000         0.4662         0.5620         0.5120         0.5160         0.5139         0.5239         0.5279         0.5319         0.5359           0.1         0.5339         0.4523         0.5871         0.5510         0.5557         0.5500         0.5664         0.6179         0.5239         0.5279         0.5319         0.5359           0.2         0.5339         0.5871         0.5517         0.5550			0.2389				0.2255		0.2206		0.2148
-0.4							0.2912				
-0.3         0.3821         0.3785         0.3745         0.3707         0.3669         0.3692         0.3594         0.3557         0.3520         0.3483           -0.2         0.4407         0.4166         0.4129         0.4052         0.4031         0.3936         0.3897         0.3889           -0.1         0.4602         0.4562         0.4483         0.4443         0.4404         0.4364         0.4325         0.4281         0.4416           0.0         0.5000         0.4960         0.4820         0.4840         0.4601         0.4721         0.4681         0.4610           0.0         0.5000         0.5040         0.5080         0.5120         0.5160         0.5139         0.5239         0.5279         0.5319         0.5359           0.1         0.5398         0.4583         0.4581         0.5170         0.5557         0.5500         0.5664         0.6170         0.6263         0.6677         0.6264         0.6170         0.67793         0.6878         0.64443         0.6464         0.6517         0.6264         0.6517         0.6264         0.6517         0.6286         0.6664         0.6790         0.6788         0.7712         0.7684         0.68772         0.6888         0.6404	-0.4										
-0.1 0.460°2 0.456°2 0.456°2 0.448°3 0.444°4 0.436°4 0.4325 0.428°5 0.428°6 0.426°6 0.4920 0.488°0 0.484°0 4.80°1 0.476°1 0.4721 0.468°1 0.468°1 0.456°1 0.4721 0.535°9 0.535°	-0.3			0.3745							
-0.0         0.5000         0.4960         0.4920         0.4880         0.4840         0.4761         0.4721         0.4681         0.4721         0.4721         0.4681           0.0         0.5000         0.5000         0.5040         0.5120         0.5150         0.5199         0.5239         0.5275         0.5339         0.5478         0.5478         0.5170         0.5567         0.5590         0.5696         0.5696         0.5696         0.5696         0.6064         0.6064         0.6173         0.5783           0.4         0.6179         0.6217         0.6228         0.6664         0.6790         0.6331         0.6368         0.6406         0.6443         0.6180         0.6661           0.4         0.6551         0.6228         0.6664         0.6700         0.6785         0.7123         0.7129         0.7123         0.7129         0.7099         0.7094         0.7734         0.7753         0.7123         0.7580         0.6617         0.6486         0.7123         0.7649         0.7422         0.7452         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454         0.7454 <th></th>											
0.0         0.5000         0.5040         0.5080         0.5120         0.5160         0.5199         0.5239         0.5279         0.5319         0.5319           0.1         0.5398         0.5438         0.5478         0.5617         0.5509         0.5696         0.5696         0.6696         0.6664         0.6131         0.5319         0.5319         0.5539         0.5617         0.5910         0.5988         0.6906         0.6664         0.6064         0.6103         0.6141           0.3         0.6179         0.0217         0.6285         0.6664         0.6700         0.6785         0.6772         0.6808         0.6664         0.6671           0.4         0.6554         0.6596         0.6986         0.6700         0.6785         0.6772         0.6808         0.6644         0.6874           0.5         0.6181         0.6986         0.6964         0.6700         0.6785         0.7712         0.7647         0.7600         0.6782         0.7127         0.7644         0.7467         0.7764         0.7704         0.7714         0.7764         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745											
0.1         0.5398         0.5478         0.5478         0.5517         0.5567         0.5696         0.5675         0.5731         0.5773           0.2         0.5793         0.5893         0.5871         0.5916         0.5948         0.5989         0.6626         0.6086         0.6086         0.6080         0.6103         0.6114           0.3         0.6179         0.0217         0.6255         0.6294         0.6301         0.6388         0.6406         0.6444         0.6480         0.6684         0.6517           0.5         0.6916         0.6986         0.7079         0.7054         0.7088         0.7123         0.7167         0.7190         0.7224           0.6         0.7257         0.7291         0.7324         0.7357         0.7389         0.7422         0.7456         0.7469         0.7167         0.7764         0.7734         0.7744         0.7744         0.7746         0.7744         0.7744         0.7746         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745         0.7745											
0.2         0.5793         0.5871         0.5910         0.5948         0.5987         0.6026         0.6044         0.6140         0.6141           0.3         0.6179         0.0217         0.6255         0.6293         0.6388         0.6406         0.6444         0.6486         0.6510           0.4         0.6584         0.6590         0.6684         0.6664         0.6700         0.6785         0.6772         0.5808         0.6844         0.6879           0.5         0.6916         0.6950         0.6968         0.7587         0.7764         0.7688         0.7127         0.7190         0.7294           0.6         0.7857         0.7291         0.7324         0.7357         0.7764         0.7764         0.7454         0.7454         0.7468         0.7517         0.7639           0.7         0.7860         0.7611         0.7623         0.7673         0.7704         0.7344         0.7444         0.7744         0.7454         0.7454         0.7652         0.8536         0.8506         0.8536         0.8526         0.8233         0.8651         0.85740         0.8516         0.8316         0.8316         0.8316         0.8316         0.8316         0.8316         0.8316         0.8316         0											
0.4         0.6854         0.6854         0.6928         0.6664         0.6700         0.6775         0.6772         0.6808         0.6844         0.6874           0.5         0.6916         0.4986         0.7095         0.7054         0.7058         0.7128         0.7129         0.7159         0.7094           0.6         0.7857         0.7291         0.7324         0.7357         0.7730         0.7734         0.7744         0.7734         0.7454         0.7456         0.7648         0.7517         0.7763           0.8         0.7881         0.7010         0.7039         0.7037         0.7744         0.7734         0.7744         0.7734 <th></th>											
0.5											
0.6         0.7857         0.7291         0.7324         0.7357         0.7482         0.7452         0.7452         0.7454         0.7456         0.7517         0.7549           0.7         0.7850         0.7611         0.7629         0.7704         0.7734         0.7834         0.8835         0.8836         0.8836         0.8836         0.8836         0.8836         0.8836         0.8837         0.9834         0.8844         0.8862         0.88937         0.9917         0.9734         0.9844         0.8862         0.8936         0.9837         0.9917         0.9732         0.9441											
0.7         0.7880         0.7611         0.7642         0.7763         0.7704         0.7764         0.7764         0.7785         0.7853         0.7853         0.7852           0.8         0.7881         0.7910         0.7097         0.7995         0.803         0.8615         0.8774         0.7853         0.8666         0.8333           0.9         0.8159         0.8186         0.8212         0.8238         0.8204         0.8289         0.8315         0.8340         0.8365         0.8389           1.0         0.8433         0.8481         0.8610         0.8858         0.8507         0.8529         0.8749         0.8770         0.8790         0.8211           1.1         0.8573         0.8669         0.8886         0.8807         0.8922         0.844         0.8869         0.8880         0.8897         0.9922         0.8940         0.8860         0.8886         0.8807         0.8922         0.8940         0.9852         0.8941         0.9860         0.9852         0.8941         0.9916         0.9115         0.9113         0.9142         0.9162         0.9911         0.4918         0.9416         0.9142         0.9416         0.9116         0.9113         0.9142         0.9416         0.9141											
0.8         0.7881         0.7981         0.7909         0.7969         0.7969         0.8023         0.8051         0.8078         0.8166         0.8132           1.0         9.6140         0.8180         0.8216         0.8216         0.8248         0.8216         0.8248         0.8216         0.8288         0.8508         0.8581         0.8564         0.85877         0.8599         0.8813           1.1         0.8643         0.8661         0.8488         0.8608         0.8708         0.8749         0.8770         0.8770         0.8599         0.8813           1.2         0.8440         0.8862         0.8808         0.8802         0.8922         0.8444         0.8862         0.8897         0.9115           1.3         0.9032         0.9049         0.9066         0.9082         0.9099         0.9115         0.9131         0.9147         0.9162         0.9176         0.9177         0.9122         0.9306         0.9317         0.9122         0.9306         0.9317         0.9122         0.9306         0.9317         0.9115         0.9036         0.9318         0.9306         0.9418         0.9420         0.9411         0.9116         0.9522         0.9306         0.9311         0.9412         0.9411											
0.9         0.9140         0.8186         0.8212         0.8288         0.8204         0.8299         0.8215         0.8340         0.8365         0.8389           1.0         7.6813         0.8488         0.8461         0.8485         0.8591         0.8531         0.85840         0.8577         0.8599         0.8671           1.1         0.8665         0.8665         0.8686         0.8798         0.8729         0.8749         0.8770         0.8790         0.8831           1.2         0.8849         0.8869         0.8882         0.8907         0.8925         0.8941         0.8962         0.8880         0.8907         0.9115           1.3         0.9032         0.9049         0.9066         0.9116         0.9111         0.9131         0.9141         0.9162         0.9117           1.4         0.9192         0.9207         0.9222         0.9360         0.9581         0.9506         0.9579         0.9202         0.9306         0.9511           1.5         0.9332         0.9348         0.9469         0.9566         0.9515         0.9418         0.9402         0.9411           1.6         0.9452         0.9403         0.9474         0.9582         0.9560         0.9515											
1.0											
1.2         0.8849         0.8868         0.8807         0.8925         0.8944         0.8962         0.8980         0.8997         0.9015           1.3         0.9032         0.9049         0.9066         0.9115         0.9131         0.9147         0.9162         0.9714           1.4         0.9192         0.9207         0.9222         0.9236         0.9251         0.9265         0.9279         0.9222         0.9306         0.9311           1.6         0.9332         0.9346         0.9367         0.0882         0.9364         0.9461         0.9412         0.9414           1.6         0.9452         0.9443         0.9484         0.9495         0.9506         0.9815         0.9525         0.9535         0.9535         0.9543           1.7         0.9564         0.9649         0.9582         0.9540         0.9608         0.9608         0.9616         0.9815         0.9525         0.9533           1.8         0.8641         0.9649         0.9582         0.9534         0.9588         0.9608         0.9608         0.9608         0.9616         0.9608         0.9609         0.9771         0.9783         0.9788         0.9608         0.9608         0.9613         0.9625         0.9678 <th>1.0</th> <th>0:8413</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	1.0	0:8413									
1.3         0.9032         0.9049         0.9066         0.9082         0.9099         0.9115         0.9131         0.9147         0.9162         0.9177           1.4         0.9192         0.9207         0.9281         0.9265         0.9279         0.9260         0.9319           1.5         0.9332         0.9345         0.9367         0.9387         0.9384         0.9364         0.9418         0.9429         0.9411           1.6         0.9452         0.9463         0.9543         0.9484         0.9465         0.9506         0.9515         0.9526         0.9535         0.9543           1.7         0.9544         0.9640         0.9564         0.9640         0.9568         0.9671         0.9578         0.9583         0.9582         0.9571         0.9788         0.9698         0.9610         0.9616         0.9615         0.9673         0.9583         0.9671         0.9788         0.9680         0.9616         0.9615         0.9673         0.9684         0.9673         0.9680         0.9611         0.9672         0.9678         0.9680         0.9616         0.9625         0.9693         0.9772         0.9772         0.9772         0.9772         0.9772         0.9773         0.9774         0.9760	1.1	0.3013	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.6810	0.8830
1.4         0.9192         0.9207         0.9222         0.9236         0.9251         0.9265         0.9279         0.9292         0.9306         0.9310           1.5         0.9392         0.9346         0.9366         0.9364         0.9466         0.9412         0.9421         0.9412         0.9414         0.9482         0.9344         0.9468         0.9564         0.9561         0.9515         0.9525         0.9535         0.9582         0.9581         0.9565         0.9515         0.9525         0.9535         0.9584           1.7         0.9584         0.9664         0.9664         0.9582         0.9581         0.9589         0.9608         0.9616         0.9625         0.9633           1.8         0.5641         0.9649         0.9686         0.9606         0.9688         0.9688         0.9633         0.9699         0.9771         0.9788         0.9688         0.9681         0.9699         0.9701           1.9         0.9772         0.9778         0.9783         0.9798         0.9998         0.9801         0.9861         0.9861         0.9861         0.9861         0.9861         0.9861         0.9861         0.9861         0.9861         0.9861         0.9862         0.9861         0.9862											
1.5											
1.0         0.9452         0.9442         0.9444         0.9498         0.9565         0.9515         0.9525         0.9535         0.0543           1.7         0.9554         0.9564         0.9582         0.9581         0.9599         0.9686         0.9635         0.9525         0.9535           1.8         0.9541         0.9649         0.9586         0.9684         0.9678         0.9686         0.9633         0.9699         0.9706           1.9         0.9272         0.9778         0.9783         0.9788         0.9744         0.9756         0.9766         0.9782         0.9744         0.9766         0.9701         0.9772           2.0         0.9772         0.9778         0.9783         0.9788         0.9744         0.9756         0.9783         0.9836         0.9803         0.9696         0.9837           2.1         0.9826         0.9830         0.9783         0.9836         0.9842         0.9840         0.9857         0.9857         0.9840         0.9851         0.9857         0.9857         0.9857         0.9851         0.9854         0.9857         0.9857         0.9857         0.9857         0.9857         0.9857         0.9857         0.9857         0.9857         0.9857         0.	1.5										
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2.0         0.9772         0.9778         0.9783         0.9788         0.9798         0.9798         0.9603         0.8608         0.9836         0.9817           2.1         0.9867         0.9836         0.9834         0.9842         0.9842         0.9846         0.9858         0.9858           2.2         0.9861         0.8664         0.9688         0.9871         0.9875         0.9878         0.9881         0.9887         0.9887           0.9882         0.9893         0.9993         0.9901         0.9904         0.9906         0.9911         0.9911         0.9911         0.9911         0.9912         0.9927         0.9929         0.9931         0.9932         0.9927         0.9929         0.9931         0.9944         0.9946         0.9946         0.9954         0.9952         0.9959         0.9948         0.9940         0.9951         0.9952         0.9959         0.9948         0.9940         0.9951         0.9952         0.9959         0.9948         0.9940         0.9951         0.9952         0.9959         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960<											
2.1         D-9827         0.9826         0.9830         0.9830         0.9831         0.9824         0.9828         0.9846         0.9850         0.9850         0.9850         0.9850         0.9850         0.9850         0.9854         0.9857         0.9858         0.9850         0.9887         0.9890         0.9887         0.9890         0.9986         0.9890         0.9990         0.9991         0.9911         0.9913         0.9913         0.9913         0.9914         0.9913         0.9914         0.9916         0.9916         0.9910         0.9911         0.9913         0.9914         0.9918         0.9916         0.9916         0.9911         0.9913         0.9914         0.9916         0.9916         0.9916         0.9911         0.9914         0.9918           2.5         0.9938         0.9941         0.9945         0.9946         0.9946         0.9948         0.9940         0.9941         0.9940         0.9940         0.9941         0.9940         0.9940         0.9941         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940         0.9940											
2.2         0.0861         0.0868         0.0868         0.0871         0.9875         0.9878         0.9881         0.9884         0.9897         0.9896           2.3         0.9893         0.9890         0.9898         0.9901         0.9904         0.9900         0.9909         0.9901         0.9909         0.9901         0.9910         0.9911         0.9913         0.9913         0.9913         0.9914         0.9914         0.9922         0.9923         0.9931         0.9934         0.9944         0.9924         0.9948         0.9946         0.9969         0.9983         0.9948         0.9940         0.9961         0.9962         0.9969         0.9960         0.9960         0.9960         0.9962         0.9963         0.9964         0.9969         0.9960         0.9960         0.9962         0.9963         0.9964         0.9969         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9960         0.9971         0.9972         0.9972         0.9973         0.9974         0.9974         0.9972         0.9972         0.9972         0.9972											
2.3         0.9893         0.9896         0.9898         0.9991         0.9904         0.9906         0.9909         0.9913         0.9913         0.9913         0.9913         0.9913         0.9914         0.9918         0.9926         0.9927         0.9929         0.0939         0.9931         0.9932         0.9944         0.9934         0.9948         0.9949         0.9931         0.9948         0.9949         0.9949         0.9951         0.9552           2.5         0.0983         0.9965         0.9965         0.9967         0.9969         0.9960         0.9961         0.9962         0.9962         0.9972         0.9972         0.9971         0.9961         0.9962         0.9963         0.9964         0.9964         0.9964         0.9961         0.9962         0.9963         0.9961         0.9962         0.9963         0.9961         0.9962         0.9972         0.9972         0.9972         0.9972         0.9961         0.9962         0.9973         0.9964         0.9964         0.9961         0.9972         0.9973         0.9974         0.9972         0.9972         0.9972         0.9972         0.9973         0.9974         0.9983         0.9984         0.9984         0.9984         0.9984         0.9984         0.9984											
2.4         0.9918         0.9920         0.9922         0.9928         0.9927         0.9929         0.9939         0.9931         0.9932         0.9934         0.9932           2.5         0.6938         0.9940         0.9941         0.9943         0.9945         0.9948         0.9948         0.9949         0.9961         0.9962           2.6         0.9955         0.9966         0.9967         0.9958         0.9969         0.9880         0.9961         0.9962         0.9933         0.9944           2.7         0.9965         0.9967         0.9957         0.9958         0.9997         0.9978         0.9972         0.9972         0.9972         0.9972         0.9972         0.9972         0.9972         0.9972         0.9972         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9985         0.9985         0.9985         0.9986         0.9986         0.9985         0.9985         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986         0.9986 <th></th>											
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2.6         0.9974         0.9975         0.9876         0.9876         0.9977         0.9977         0.9978         0.9979         0.9979         0.9980         0.9981           2.9         0.0981         0.9982         0.9983         0.9984         0.9984         0.9985         0.9985         0.9986         0.9996         0.9992         0.9992         0.9992         0.9992         0.9993         0.9996         0.9996         0.9996         0.9996         0.9996         0.9996         0.9996											
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3.0         0.9987         0.9987         0.9987         0.9988         0.9988         0.9989         0.9982         0.9992         0.9993         0.9993         0.9993         0.9993         0.9993         0.9993         0.9993         0.9993         0.9993         0.9994 <th></th>											
3.1         0.9900         0.9991         0.9991         0.9992         0.9992         0.9992         0.9992         0.9993         0.9993         0.9993           3.2         0.9993         0.9993         0.9994         0.9994         0.9994         0.9994         0.9995         0.9995         0.9996											
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1. Consider a random variable, X, distributed exponentially with parameter  $\lambda$ ; i.e.,  $X \sim \exp(\lambda)$ .

(a) Compute the mean of X,  $\mathbb{E}(X)$ .

The station 
$$f_{x}(x) = \lambda e^{-\lambda x}$$
 $f_{x}(x) = \lambda e^{-\lambda x}$ 
 $f_{x}(x$ 

(b) Compute the variance of X, var(X).

$$Vov(x) = E[x^{2}] - (E[x])$$

$$= \int_{-\infty}^{\infty} f_{x}(x) dx - (x^{2})$$

$$= \int_{-\infty}^{\infty} f_{x}(x) dx - (x^{2}) dx - (x^{2})$$

$$= \int_{-\infty}^{\infty} f_{x}(x) dx - (x^{2}) dx - (x^{2})$$

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$$= \int_{-\infty}^{\infty} f_{x}(x) dx - (x^{2}) dx - (x^{2})$$

 $=\frac{1}{\lambda^2}$ 

Thresharms

Fulle

Lix SV= e-1xd

V=-1xd

V=-1

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2. Let X be a random variable that takes values from 0 to 9 with equal probability 1/10.

(a) Find the PMF of the random variable  $Y=X \mod (3)$ .

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of the random variable 
$$Y = X \mod (3)$$
.

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(b) Find the PMF of the random variable  $Y=5 \mod (X+1)$ .

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3. Suppose you are to throw a dart at a circular dart board with radius 2 inches. Let (X,Y) denote the point that you hit on the board (you can assume the board is centered at the origin (0,0), and that the dart hits somewhere on the board uniformly at random).

(a) Define  $C_r := \{(x,y)|x^2 + y^2 = r^2\}$ . Show that the probability that you hit a point at any given fixed distance from the center is 0; i.e.,  $\mathbb{P}((X,Y) \in C_r) = 0$  for all r > 0.

fx,y (X,y) = aven of aven.

Very Polar. Coordinates X= Klose, Y=Ksive  $P((x,y) \in G) = \sqrt{2\pi} / x fx,y (x(K,Q),y(K,Q)) \times dx de$ 

(c) Compute the PDF of R,  $f_R(r)$ .

$$f_{R}(r) = \frac{1}{2} f_{R}(r) =$$

The Jistante between 
$$(X,Y)$$
 and the origin.

The Jistante between  $(X,Y)$  and the origin.

Prigin is the vandom variable  $R$  from  $EM/M$ 
 $E[R] = \int_{0}^{\infty} \int_{0}^{\infty} f_{R}(Y) dY = \int_{0}^{\infty} \int_{0}^{\infty} \frac{1}{6} \int_{0}^{\infty} f_{R}(Y) dY = \int_{0}^{\infty} \frac{1}{6} \int_{0$ 

(e) Suppose you know X = 1. What is the PDF of Y conditioned on this fact?

$$f_{Y|X}(Y|X=) = f_{X}(Y|Y)$$
  
 $f_{X}(Y|X=) = f_{X}(Y|Y)$   
 $f_{X}(Y|X=) = f_{X}(Y|Y)$ 

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4. A baseball team loses \$100,000 for each consecutive day it rains. Say X, the number of consecutive days it rains at the beginning of the season, has a Poisson distribution with mean 0.2. What is the expected loss before the opening game?

$$P_{K}(K) = e^{-\lambda_{1}} \frac{\lambda_{1}}{K!} \qquad \lambda = 0, 2 \text{ Since}$$

$$= e^{-\partial_{1} 2} (0, 2)^{\frac{1}{K}}$$

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by linearity of

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5. Let N be a nonnegative integer-valued random variable, and let  $X_i$  be a sequence of independent and identically distributed random variables. Assume  $\mathbb{E}[X_i]$  and  $\mathbb{E}[N]$  are finite. Show that  $\mathbb{E}[X_1 + X_2 + ... + X_N] = \mathbb{E}[X_1]\mathbb{E}[N]$ .

E [x,+x2+ ... xn]

DE EXITE EXIT INTEXNI = EXIT EXIT EXPLITATION

Since Xi are all isual cally distributed and indigendent we mu EXIT = EXIT

This we get

O = E[X] E[M]

grinned in step 1 is £ [N]

- 6. A company pays its junior employees salaries which are approximately normally distributed with a standard deviations of \$5,000 and a mean of \$75,000.
  - (a) At a specific branch, there are 100 junior employees. Assuming the salaries are independent and identically distributed according to the distribution above, what is the probability that the maximum salary and the minimum salary are both within \$5,000 of the mean? Hint: Use the CDF table to compute the probability that one salary is within \$5,000 of the mean and then extend this to the maximum and minimum salaries (you don't need to simplify the exponential at the end).

N=75000 6=5000

P(nin and max within 5000 of mean)

= P(all pm pblyees make between 70000 and 80000)

= [P(one employee makes between 70 k and 80 k)]

- Giver employee son larves are independent and identically plantically historialization for malizing to sandant normal 2a=80k-70k=1 2b=70k-70k

- Mormalizing to sandant normal 2a=80k-70k=1 2b=70k-70k

= [P(25 \frac{20}{20}) - P(25 \frac{20}{20})] [00] [00) - \$\psi(-1)] [00] [0.8413-0.158)] [00]

(b) At a specific branch, there are 100 junior employees. Assuming the salaries are independent and identically distributed according to the distribution above, what is the probability that the average salary is within \$1,000 of the mean?

Salary is within \$1,000 of the mean?

Let  $X_n = C_0 | a_n y$  of nth employed for n=1, 1/20Let  $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_n y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $A = C_1 v_1 v_2 a_0 e$   $SC_0 | a_1 y$   $X_1 | a_1 e$   $SC_0 | a_1 e$   $SC_0 | a_1 y$   $SC_0 | a_1 e$   $SC_0 |$ 

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7. Suppose you flip a fair coin repeatedly until you see a Tails followed by a Heads. What is the expected

number of coin flips you have to flip? = # of coin Flips By law of total -EX Heltarmy FEXT= EFEXITY + REDITY E[X/H,] = L, E[X/H, To] + = E[X/H,H2] E[XIM] = {(HE[X/T]) + E(HE[X/H]) EDIMI - It & EDITI TEEDIMI LEQHII = HEEXIM EQIHJ = 2+ ECX/T,J-ETXITID= SECXITHOD + SECXITTED EDITI = {(2) + {(HECXITI)) EDITI = 1+ 1 + LECVITI E[XITI]= 3 7 = 1 (5) + 1 (3)

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8. Suppose 3 players are playing a game in which they sequentially draw one of 8 balls from a bag. Two of the balls are red and one is blue, and the first player who draws the blue ball from the bag is the winner.

(a) If each player draws one ball from the bag at random and doesn't replace the ball, compute the probability that the third player wins the game.

(b) If each player draws one ball from the bag at random and replaces the ball (each player gets only one draw), compute the probability that the third player wins the game.

P(Thirt wins) = + (first Net) P(second red) = 3,3 = 4

(c) If each player draws one ball from the bag at random and replaces the ball (each player gets only one draw), compute the probability that no player wins the game.

P(no winner) = P(find red) P(socond red)P(Third recd)
= 3 (3) (3) - 27

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9. Suppose the joint PDF of random variables X and Y,  $f_{X,Y}(x,y)$ , is symmetric about the line x=c; that is  $f_{X,Y}(c+t,y)=f_{X,Y}(c-t,y)$  for all  $t\geq 0$  and all y. Prove that the marginal CDF of X satisfies  $F_X(c)=0.5$ .

( , 6,4(X/Y) dy su Sstitutian Fx(c)= S= fxy(xy)dy= 0.5 .

10. The coordinates X and Y of a point are independent standard normal random variables. Given that the point is at a distance of at least 1 from the origin, find the conditional joint PDF of X and Y.

Condition of a + least 2 from the original implies 
$$(x^2 + y^2 \ge 1)$$
  
Standard normal independent means  $(x^2 + y^2 \ge 1)$   
Let A be the event that  $(y^2 + y^2 \ge 1)$   
 $f_{X,Y}(A) = \frac{f_{X,Y}(y,y)}{f(A)} = \frac{f_{X}(x)}{f_{Y}(y)} + \frac{f_{X}(x)}{f_{Y}(y)} \frac{f_{X}(x)}{f_{Y}$ 

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11. Suppose two independent claims are made on two insured homes, where each claim has pdf

$$f_X(x) = \frac{4}{x^5}, \quad 1 < x < \infty,$$

in which the units are \$1000. Find the expected value of the larger claim. Hint: If  $X_1$  and  $X_2$  are the two independent claims and  $Y = \max(X_1, X_2)$  then

12. You go to a party with 500 guests. What is the probability that exactly one other guest has the same birthday as you? For simplicity, ignore leap years and assume that every year has exactly 365 days with a given birthday equally likely to be on any of these days.

P(1 of NeV sinst has sant b, 14h Jay)  $= (500) \frac{1}{365} (364) 499$   $= (1) \frac{3}{3}65 (365)$   $= (1) \frac{3}65 (365)$   $= (1) \frac{3}{3}65 (365)$   $= (1) \frac{3}{3}65 (365)$  = (1

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