COMM 215 COORDINATION SAMPLE QUESTIONS

This sample is provided by professors of JMSB to students for the purpose of midterm practice. This sample **must** not be used for commercial purposes.

This is a sample that may or may not be representative of a midterm from one year to another but intends to help students study for their course.

Exam

Name________________________________

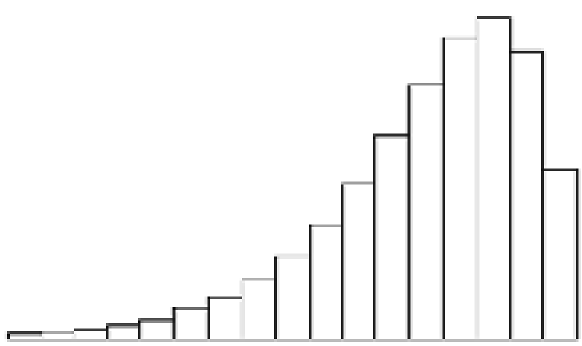
MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Which is *least likely* to be an application where statistics will be useful? 1) ______
A) Predicting whether an airfare is likely to rise or fall
B) Designing the most desirable features for a ski pass
C) Deciding whether offering Rice Krispies improves restaurant sales
D) Choosing the wording of a corporate policy prohibiting smoking

2) Which statement is *correct*? 2) ______
A) Judgment sampling is preferred to systematic sampling.
B) Sampling without replacement introduces bias in our estimates of parameters.
C) Cluster sampling is useful when strata characteristics are unknown.
D) Focus groups usually work best without a moderator.

3) Professor Hardtack chose a sample of 7 students from his statistics class of 35 students by picking every student who was wearing red that day. Which kind of sample is this? 3) ______
A) Simple random sample
B) Judgment sample
C) Systematic sample
D) Convenience sample

4) The distribution pictured below is: 4) ______



A) bimodal and skewed right.
B) bimodal and skewed left.
C) skewed right.
D) skewed left.

5) A population is of size 5,500 observations. When the data are represented in a relative frequency distribution, the relative frequency of a given interval is 0.15. The frequency in this interval is equal to: 5) ______
A) 4,675.
B) 800.
C) 675.
D) 825.

6) Which is *not* true of the Empirical Rule? 6) ______

A) It applies to any distribution.
B) It can be applied to fewer distributions than Chebyshev's Theorem.
C) It assumes that the distribution of data follows a bell-shaped, normal curve.
D) It predicts more observations within $\mu \pm k\sigma$ than Chebyshev's Theorem.

7) Which is a *correct* statement concerning the median? 7) ______

A) In a left-skewed distribution, we expect that the median will exceed the mean.
B) The sum of the deviations around the median is zero.
C) The median is an observed data value in any data set.
D) The median is halfway between Q_1 and Q_3 on a box plot.

8) The 25th percentile for waiting time in a doctor's office is 19 minutes. The 75th percentile is 31 minutes. The interquartile range is: 8) ______

A) 12 minutes.
B) 16 minutes.
C) 22 minutes.
D) impossible to determine without knowing n.

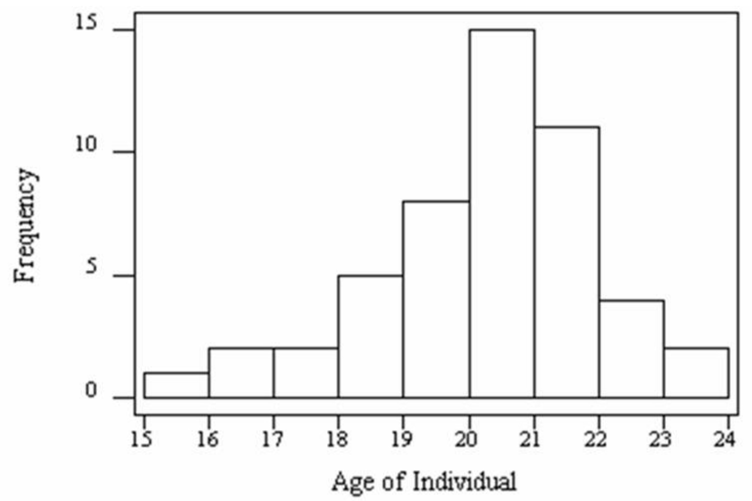
9) Here are statistics on order sizes of Megalith Construction Supply's shipments of two kinds of construction materials last year. 9) ______

	Girders	*Rivets*
Mean	160	2800
Std. Dev.	48	702

Which order sizes have greater variability?

A) Girders
B) Rivets
C) They are the same.
D) Cannot be determined without knowing n

10) VenalCo Market Research surveyed 50 individuals who recently purchased a certain CD, revealing the age distribution shown below. Which statement is *least* defensible? 10) _____



A) The mean age probably exceeds the median age.
B) The mode would be a reasonable measure of center.
C) The data are somewhat skewed to the left.
D) The CD is unlikely to appeal to retirees.

11) Ramjac Company wants to set up k independent file servers, each capable of running the company's intranet. Each server has average "uptime" of 98 percent. What must k be to achieve 99.999 percent probability that the intranet will be "up"? 11) _____

A) 1 B) 2 C) 3 D) 4

12) A charity raffle prize is $1,000. The charity sells 4,000 raffle tickets. One winner will be selected at random. At what ticket price would a ticket buyer expect to break even? 12) _____

A) $0.50 B) $0.25 C) $0.75 D) $1.00

13) If $P(A \cap B) = 0.50$, can $P(A) = 0.20$? 13) _____

A) Only if $P(A \mid B) = 0.10$
B) Not unless $P(B) = 0.30$
C) Only if $P(B \cap A) = 0.60$
D) If $P(A) = 0.20$, then $P(A \cap B)$ cannot equal 0.50.

14) The discrete random variable X is the number of students that show up for Professor Smith's office hours on Monday afternoons. The table below shows the probability distribution for X. What is the expected value $E(X)$ for this distribution? 14) _____

X	0	1	2	3	Total
$P(X)$	.40	.30	.20	.10	1.00

A) 1.2 B) 1.0 C) 1.5 D) 2.0

15) Given the contingency table shown here, find $P(F \text{ or } G)$. 15) _____

	Major			
Gender	*Accounting (A)*	*Gen. Mgmt. (G)*	*Economics (E)*	Row Tot
Male (M)	210	180	140	530
Female (F)	150	160	160	470
Col Total	360	340	300	1000

A) .160 B) .470 C) .650 D) .810

16) Given the contingency table shown here, find $P(A_1 \cap A_2)$. 16) _____

	A_1	A_2	A_3	A_4	Row Tot
B_1	12	26	42	68	148
B_2	14	28	44	64	150
B_3	18	32	47	72	169
Col Total	44	86	133	204	467

A) .00 B) .09 C) .28 D) .38

17) The lengths of brook trout caught in a certain Colorado stream are normally distributed with a mean of 14 inches and a standard deviation of 3 inches. What lower limit should the State Game Commission set on length if it is desired that 80 percent of the catch may be kept by fishers? 17) _____

A) 12.80 inches B) 11.48 inches
C) 12.00 inches D) 9.22 inches

18) Assume that X is normally distributed with a mean $\mu = \$64$. Given that $P(X \geq \$75) = 0.2981$, we can calculate that the standard deviation of X is approximately: 18) _____

A) \$20.76. B) \$13.17. C) \$5.83. D) \$7.05.

19) The random variable X is normally distributed with mean of 80 and variance of 36. The 67^{th} percentile of the distribution is: 19) _____

A) 72.00. B) 95.84. C) 90.00. D) 82.64.

20) If the mean time between in-flight aircraft engine shutdowns is 12,500 operating hours, the 90^{th} percentile of waiting times to the next shutdown will be: 20) _____

A) 20,180 hours. B) 28,782 hours.
C) 23,733 hours. D) 18,724 hours.

1-An inspector working for a manufacturing company has a 99% chance of correctly identifying defective items and a 0.5% chance of incorrectly classifying a good item as defective. The company has evidence that its line produces 0.9% of nonconforming items.

a) What is the probability that an item selected for inspection is classified as defective?

b) If an item selected at random is classified as non-defective, what is the probability that it is indeed good?

2-Four inspectors in a food factory are responsible for stamping the expiration date on each package, and their information is provided as follows.

- Adam stamps 30% of the packages and fails to stamp the expiration date once in every 200 packages.
- Bob stamps 50% of the packages and fails to stamp the expiration date once in every 100 packages.
- Chris stamps 10% of the packages and fails to stamp the expiration date once in every 90 packages.
- David stamps 10% of the packages and fails to stamp the expiration date once in every 200 packages

a) If a package does not show the expiration date, what is the probability that this package was handled by Adam?

b) If a package does not show the expiration date and it was NOT handled by Chris, what is the probability that this package was handled by Bob?

3-A baker received 23 orders of cakes (one customer ordered one cake). Due to the past experience, some customers do not show up and pick up their cakes. The probability that a customer does not pick up the cake is 0.15. To minimize the waste as the leftover cakes cannot stay overnight, the baker only makes 20 cakes. Yet, customers are unhappy if they come and cannot pick their cakes.

a) Determine the probability that the baker has no leftover cake and no unhappy customers.

b) Which situation is more likely to happen: leftover cake or unhappy customers? You have to show the calculations to explain and support your answers. Random guess will receive 0 mark.

4 -

1. Statistical data gathered for Toyota cars that are returned for mechanical failure within their first year of usage show that Engine, Sensors and Breaks are the three main sources for the mechanical failures. Toyota's data provides the following information for:

   E = {Engine failures}
   B = {Break failures}
   S = {Sensor problems}

   $P(E) = 0.35$

   $P(E \cap B') = 0.29$

   $P(B \cap S) = 0.09$

   $P(B' \cap S') = 0.25$

   $P((E \cap S)/B) = 0.2$

   $P(S/E) = 9/35$

   $P(B') = 0.75$

   $P(E/B) = 6/25$

   For the given information answer the following questions (**1 mark each**)

   a) $P(E \cap S) = ?$

   b) $P(B) = ?$

   c) $P(E \cap S \cap B') = ?$

   d) $P(E \cap S \cap B) = ?$

   e) $P(B \cap E') = ?$

(HINT: A Venn diagram may be useful here)

5 -

(10 Marks) A multiple-choice quiz has 200 questions each with 4 possible answers of which only 1 is the correct answer. What is the probability that sheer guesswork yields from 25 to 30 correct answers for 80 of the 200 problems about which the student has no knowledge? **[HINT: approximation may be helpful here]**

6 -

A word consists of 3 letters. Each letter in a word may be a vowel with probability 0.2. Whether a letter is a vowel or not is independent of the other letters. Find:

(a) the probability that a word contains at least one vowel.

(b) the probability that at least 12 out of 20 words will have at least one vowel.

(c) the probability that 20 words will have a total of at least 12 vowels in them.

7 -

Supplier A and Supplier B produce two types of parts: simple parts and complex parts. In particular, Supplier A produces 1000 simple parts and 1000 complex parts, and Supplier B produces 1600 simple parts and 400 complex parts. All these parts are evaluated for conformance to specifications (i.e., defective or not). The proportions of defective parts of each type are shown in the following table.

	Number of defective simple parts	Number of defective complex parts	Total
Supplier A	2	10	12
Supplier B	4	6	10

a) Given all the parts by Suppliers A and B, what is the probability that a part conforms to specifications (i.e., non-defective)?

b) What is the probability that a part conforms to specifications given that this part is a complex part?

8 -

1. A security camera is used to monitor a particular surveillance area to report whether there is any threat present or not. The probability that the camera correctly detects an actual threat as "threat found" is 0.8. The probability that the camera correctly reports no threat as "no threat found" is 0.9. Suppose the probability of an actual threat being present in the surveillance area is 0.6.

   a. What is the probability that the camera reports "threat found"? (4 Marks)
   b. Given that the camera reports "threat found", what is the probability that there are actual threats in the surveillance area? (3 Marks)

Answer parts c) and d) by assuming that an actual threat is always present (i.e., probability of threat presence is 1)

   c. What is the probability that the camera reports "threat found"? (1 Mark)
   d. An identical second camera is used to increase the accuracy of threat reporting capability. The cameras are operating independently and monitoring the same surveillance area. Find the probability that the combined system report the threat accurately (at least one camera should report "threat found"). (2 Marks)

COMM 215 BUSINESS STATISTICS (Bowerman 8th Edition)

Chapter 2 Descriptive Statistics: Tabular and Graphical Presentations.

$$\text{approximate class length} = \frac{\text{largest measurement} - \text{smallest measurement}}{\text{number of classes}}$$

Chapter 3 Descriptive Statistics: Quantitative

Interquartile Range: $IQR = Q_3 - Q_1$

Sample Variance:

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1}$$

$$s^2 = \frac{1}{n-1}\left[\sum_{i=1}^{n} x_i^2 - \frac{(\sum_{i=1}^{n} x_i)^2}{n}\right]$$

Chapter 4 Probability

Counting Rule for Combinations: $\binom{N}{n} = \frac{N!}{n!(N-n)!}$

Addition Rule: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$

Conditional Probability: $P(A|B) = P(A \cap B)/P(B)$

The Multiplication Rule: $P\ (A \cap B) = P(B)P(A|B)$

Chapter 5 Discrete Random Variables

The Expected Value of a Discrete Random Variable:

$$\mu_x = \sum_{All\ x} xp(x)$$

Variance of a Discrete Random Variable:

$$\sigma_x^2 = \sum_{All\ x} (x - \mu_x)^2 p(x)$$

Number of ways to arrange x successes among n trials:

$$\binom{N}{n} = \frac{n!}{x!\,(n-x)!}$$

Binomial Probability Function: $P(x) = \frac{n!}{x!(n-x)!} p^x q^{n-x}$

Expected Value for the Binomial Distribution: $\mu_x = np$

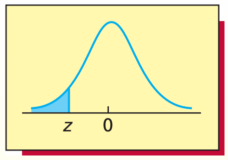
Variance for the Binomial Distribution: $\sigma_x^2 = npq$

Chapter 6 Continuous Random Variables

The Standard Normal Distribution:

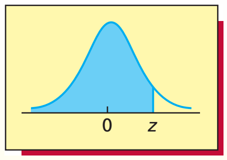
$$z = \frac{x - \mu}{\sigma}$$

TABLE A.3 Cumulative Areas under the Standard Normal Curve



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−3.9	0.00005	0.00005	0.00004	0.00004	0.00004	0.00004	0.00004	0.00004	0.00003	0.00003
−3.8	0.00007	0.00007	0.00007	0.00006	0.00006	0.00006	0.00006	0.00005	0.00005	0.00005
−3.7	0.00011	0.00010	0.00010	0.00010	0.00009	0.00009	0.00008	0.00008	0.00008	0.00008
−3.6	0.00016	0.00015	0.00015	0.00014	0.00014	0.00013	0.00013	0.00012	0.00012	0.00011
−3.5	0.00023	0.00022	0.00022	0.00021	0.00020	0.00019	0.00019	0.00018	0.00017	0.00017
−3.4	0.00034	0.00032	0.00031	0.00030	0.00029	0.00028	0.00027	0.00026	0.00025	0.00024
−3.3	0.00048	0.00047	0.00045	0.00043	0.00042	0.00040	0.00039	0.00038	0.00036	0.00035
−3.2	0.00069	0.00066	0.00064	0.00062	0.00060	0.00058	0.00056	0.00054	0.00052	0.00050
−3.1	0.00097	0.00094	0.00090	0.00087	0.00084	0.00082	0.00079	0.00076	0.00074	0.00071
−3.0	0.00135	0.00131	0.00126	0.00122	0.00118	0.00114	0.00111	0.00107	0.00103	0.00100
−2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
−2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
−2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
−2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
−2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
−2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
−2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
−2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
−2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
−2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
−1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
−1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
−1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
−1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
−1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
−1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
−1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
−1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
−1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
−1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
−0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
−0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
−0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
−0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2482	0.2451
−0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
−0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
−0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
−0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
−0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
−0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

TABLE A.3 Cumulative Areas under the Standard Normal Curve (*continued*)



z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7518	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
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	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.99865	0.99869	0.99874	0.99878	0.99882	0.99886	0.99889	0.99893	0.99897	0.99900
3.1	0.99903	0.99906	0.99910	0.99913	0.99916	0.99918	0.99921	0.99924	0.99926	0.99929
3.2	0.99931	0.99934	0.99936	0.99938	0.99940	0.99942	0.99944	0.99946	0.99948	0.99950
3.3	0.99952	0.99953	0.99955	0.99957	0.99958	0.99960	0.99961	0.99962	0.99964	0.99965
3.4	0.99966	0.99968	0.99969	0.99970	0.99971	0.99972	0.99973	0.99974	0.99975	0.99976
3.5	0.99977	0.99978	0.99978	0.99979	0.99980	0.99981	0.99981	0.99982	0.99983	0.99983
3.6	0.99984	0.99985	0.99985	0.99986	0.99986	0.99987	0.99987	0.99988	0.99988	0.99989
3.7	0.99989	0.99990	0.99990	0.99990	0.99991	0.99991	0.99992	0.99992	0.99992	0.99992
3.8	0.99993	0.99993	0.99993	0.99994	0.99994	0.99994	0.99994	0.99995	0.99995	0.99995
3.9	0.99995	0.99995	0.99996	0.99996	0.99996	0.99996	0.99996	0.99996	0.99997	0.99997

TABLE A.1 A Binomial Probability Table:
Binomial Probabilities (n between 2 and 6)

$n = 2$ — p

$x\downarrow$	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	
0	.9025	.8100	.7225	.6400	.5625	.4900	.4225	.3600	.3025	.2500	2
1	.0950	.1800	.2550	.3200	.3750	.4200	.4550	.4800	.4950	.5000	1
2	.0025	.0100	.0225	.0400	.0625	.0900	.1225	.1600	.2025	.2500	0
	.95	.90	.85	.80	.75	.70	.65	.60	.55	.50	$x\uparrow$

$n = 3$ — p

$x\downarrow$	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	
0	.8574	.7290	.6141	.5120	.4219	.3430	.2746	.2160	.1664	.1250	3
1	.1354	.2430	.3251	.3840	.4219	.4410	.4436	.4320	.4084	.3750	2
2	.0071	.0270	.0574	.0960	.1406	.1890	.2389	.2880	.3341	.3750	1
3	.0001	.0010	.0034	.0080	.0156	.0270	.0429	.0640	.0911	.1250	0
	.95	.90	.85	.80	.75	.70	.65	.60	.55	.50	$x\uparrow$

$n = 4$ — p

$x\downarrow$	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	
0	.8145	.6561	.5220	.4096	.3164	.2401	.1785	.1296	.0915	.0625	4
1	.1715	.2916	.3685	.4096	.4219	.4116	.3845	.3456	.2995	.2500	3
2	.0135	.0486	.0975	.1536	.2109	.2646	.3105	.3456	.3675	.3750	2
3	.0005	.0036	.0115	.0256	.0469	.0756	.1115	.1536	.2005	.2500	1
4	.0000	.0001	.0005	.0016	.0039	.0081	.0150	.0256	.0410	.0625	0
	.95	.90	.85	.80	.75	.70	.65	.60	.55	.50	$x\uparrow$

$n = 5$ — p

$x\downarrow$	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	
0	.7738	.5905	.4437	.3277	.2373	.1681	.1160	.0778	.0503	.0313	5
1	.2036	.3281	.3915	.4096	.3955	.3602	.3124	.2592	.2059	.1563	4
2	.0214	.0729	.1382	.2048	.2637	.3087	.3364	.3456	.3369	.3125	3
3	.0011	.0081	.0244	.0512	.0879	.1323	.1811	.2304	.2757	.3125	2
4	.0000	.0005	.0022	.0064	.0146	.0284	.0488	.0768	.1128	.1563	1
5	.0000	.0000	.0001	.0003	.0010	.0024	.0053	.0102	.0185	.0313	0
	.95	.90	.85	.80	.75	.70	.65	.60	.55	.50	$x\uparrow$

$n = 6$ — p

$x\downarrow$	.05	.10	.15	.20	.25	.30	.35	.40	.45	.50	
0	.7351	.5314	.3771	.2621	.1780	.1176	.0754	.0467	.0277	.0156	6
1	.2321	.3543	.3993	.3932	.3560	.3025	.2437	.1866	.1359	.0938	5
2	.0305	.0984	.1762	.2458	.2966	.3241	.3280	.3110	.2780	.2344	4
3	.0021	.0146	.0415	.0819	.1318	.1852	.2355	.2765	.3032	.3125	3
4	.0001	.0012	.0055	.0154	.0330	.0595	.0951	.1382	.1861	.2344	2
5	.0000	.0001	.0004	.0015	.0044	.0102	.0205	.0369	.0609	.0938	1
6	.0000	.0000	.0000	.0001	.0002	.0007	.0018	.0041	.0083	.0156	0
	.95	.90	.85	.80	.75	.70	.65	.60	.55	.50	$x\uparrow$

(table continued)

1) D
2) C
3) D
4) D
5) D
6) A
7) A
8) A
9) A
10) A
11) C
12) B
13) D
14) B
15) C
16) A
17) B
18) A
19) D
20) B

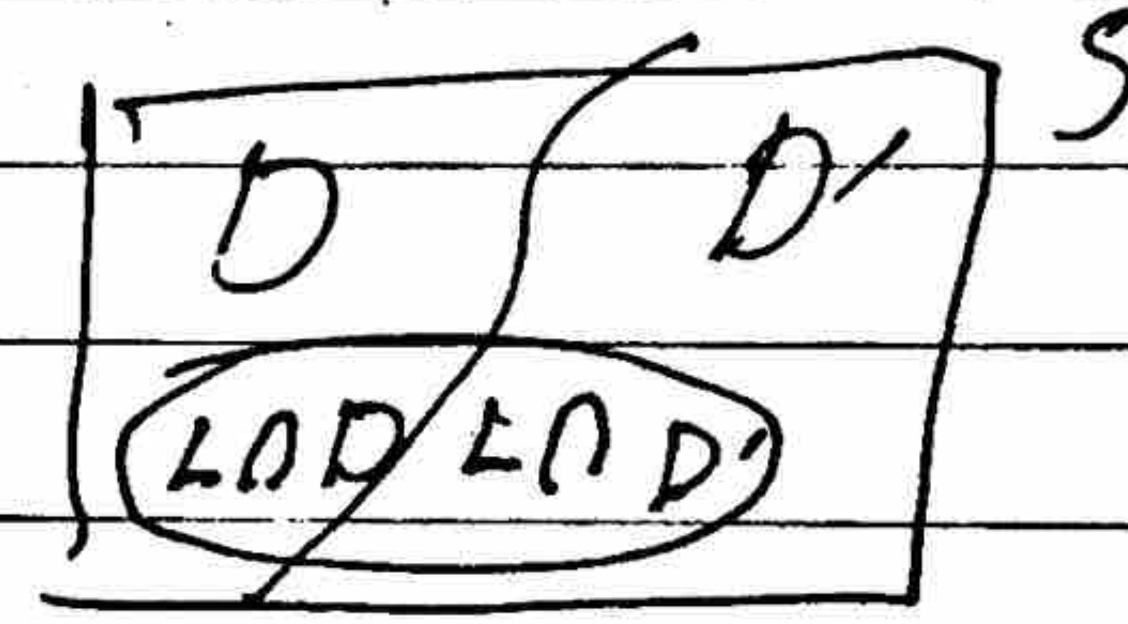
$P(\text{first}/\text{you}) = 1/8$

\#)

	D	D'
L'	$L'\cap D$	$L'\cap D'$
L	$L\cap D$	$L\cap D'$

D: Event part is defective

L : Event part is labeled as defective



$P(L|D) = 0.99$

$P(L|D') = 0.005$

$P(D) = 0.009$

a) $P(L) = P(L\cap D) + P(L\cap D') = P(L|D).P(D) + P(L|D').P(D')$

$P(L) = 0.99(0.009) + 0.005(1-0.009) = \boxed{0.013865}$

b) $P(D'|L') = \dfrac{P(D'\cap L')}{P(L')} = \dfrac{P(L'|D').P(D')}{P(L')} = \dfrac{[1-P(L|D')].P(D')}{1-P(L)}$

$= \dfrac{(1-0.005)(1-0.009)}{1-0.013865} = \dfrac{0.995\times 0.991}{0.986135}$

$= \boxed{0.9999}$

2

a) Let A, B, C, D denote the event that Adam, Bob, Chris and David does the package

Let E denote the event of missing the expiration date

$P(A) = 0.3 \quad P(B) = 0.5 \quad P(C) = 0.1 \quad P(D) = 0.1$

$P(E|A) = \frac{1}{200} \quad P(E|B) = \frac{1}{100} \quad P(E|C) = \frac{1}{90} \quad P(E|D) = \frac{1}{200}$

$P(E) = 0.3 \cdot \frac{1}{200} + 0.5 \cdot \frac{1}{100} + 0.1 \cdot \frac{1}{90} + 0.1 \frac{1}{200} = 0.008111$

$$P(A|E) = \frac{P(E|A) \cdot P(A)}{P(E)} = \frac{0.3 \cdot \frac{1}{200}}{0.00811} = 0.184932$$

b) $P(B|E \cap C') = P(B \cap E \cap C') / P(E \cap C')$

$P(E \cap C') + P(E \cap C) = P(E) \Rightarrow P(E \cap C') = 0.0081 - 0.1\left(\frac{1}{90}\right)$

$= 0.007$

$$P(B \cap E \cap C') = P(B \cap E) = \frac{0.5}{100}$$

$$P(B \mid E \cap C') = \frac{0.5/100}{0.007} = 0.7$$

* EX3-10 #3

a) X: R.V. denoting # of customers who show up

$n = 23 \quad p = 0.15$

$P(X = 20) = \binom{23}{20} 0.15^{3}\, 0.85^{20} = 0.23167$

01 X: R.V denoting customers who don't show up.

b) $E[X] = n \cdot p = 23(0.15) = 3.45$

1) It is expected that more than three customers won't show up and $23 - 3.45 = 19.55$ customers come and pick-up cakes. It is more likely to have left overs.

2) $P(X \leq 20) = P(\text{leftover}) = 1 - P(X > 20) = 1 - P(\text{unhappy customers})$

$P(X > 20) = \sum_{x=21}^{23} \binom{23}{x} (0.15)^{23-x} \cdot (0.85)^{x} = 0.3080$ (50%

It would be more likely that we would have left overs.

$\binom{23}{21} \qquad \binom{23}{22} \qquad \binom{23}{23}$

$\frac{23!}{2!\,21!} = 253 \qquad \frac{23!}{1!\,22!} = 23 \qquad 1$

$0.15^{2}\, 0.85^{21} \qquad 0.15 \cdot 0.85^{22} \qquad 0.85^{23}$

tell

#4

E: Engine failure B: Break failure S: Sensor Failure

$P(E) = 0.35$ $P(E \cap \bar{B}) = 0.29$ $P(B \cap S) = 0.09$

$P(\bar{B} \cap \bar{S}) = 0.25$ $P[(E \cap S) | B] = 0.2$ $P(S|E) = 9/35$

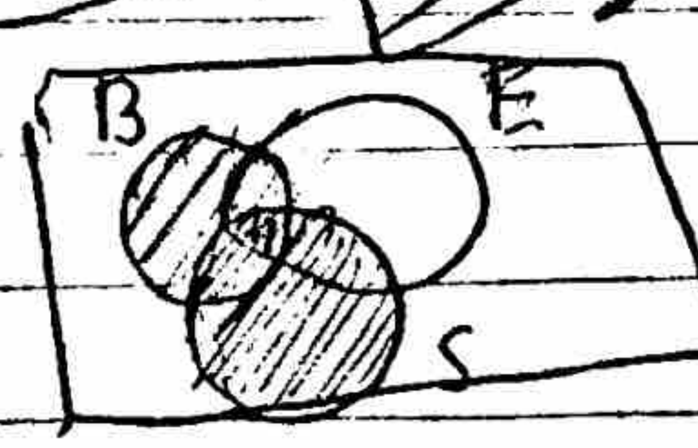
$P(\bar{B}) = 0.75$ $P(E|B) = 6/25$

a) $P(E \cap S) = P(S|E) \cdot P(E) = \frac{9}{35} \cdot 0.35 = 0.09$

b) $P(B) = 1 - P(\bar{B}) = 1 - 0.75 = 0.25$

c) $P(E \cap S \cap \bar{B}) = P(E \cap S) - P(E \cap S \cap B) = 0.09 - 0.05 = 0.04$

d) $P(E \cap S \cap B) = P[(E \cap S) | B] \cdot P(B) = 0.2 \times 0.25 = 0.05$



e) $P(B \cap \bar{E}) = P(B) - P(B \cap E) = P(B) - P(E|B) \cdot P(B)$

$= P(B)[1 - P(E|B)]$

$= 0.25\left[1 - \frac{6}{25}\right] = 0.19$

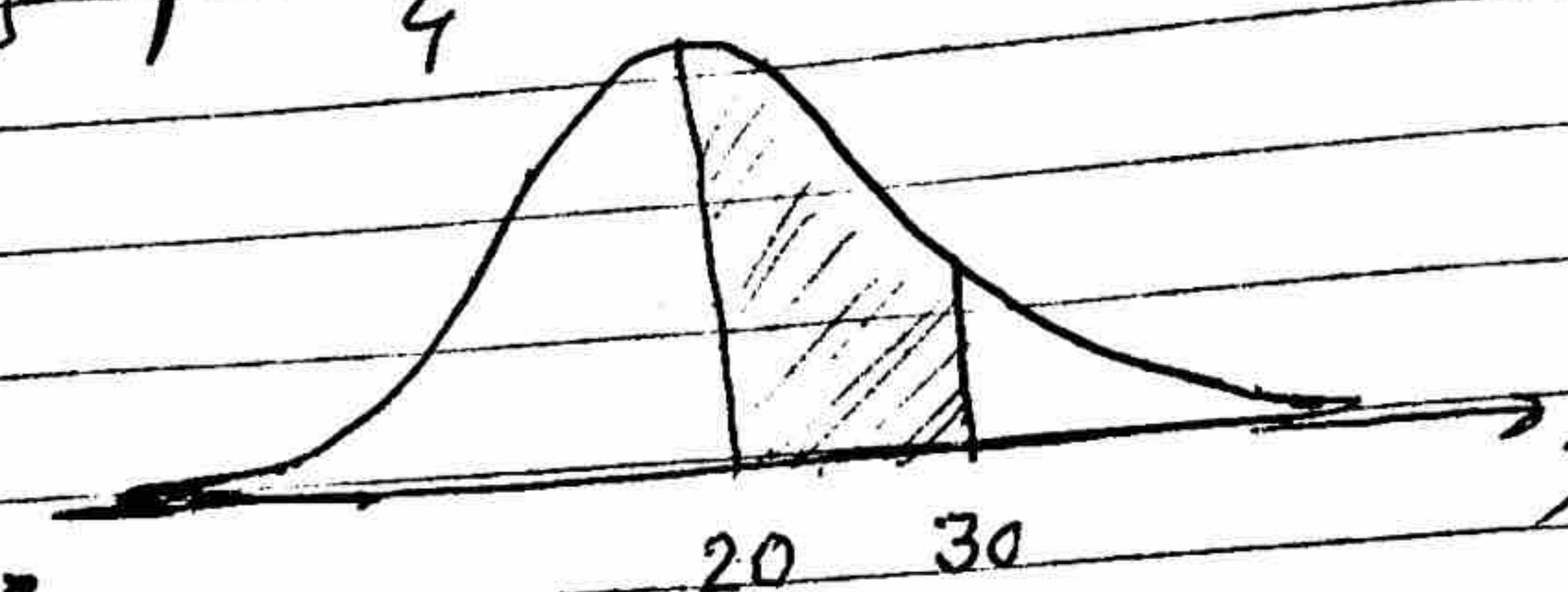
f) $P(\bar{S} \cap \bar{B}) = P(\overline{S \cup B}) = 1 - P(S \cup B) = 1 - [P(S) + P(B) - P(S \cap B)]$

$0.25 = 1 - P(S) - 0.25 + 0.09 \Rightarrow P(S) = 0.5$

8 # 5

R.V. X : # of Correct answers $p = \frac{1}{4} = 0.25$ $q = 1-p = 0.75$

$\mu = np = 80 \times \frac{1}{4} = 20 > 5$ $n(1-p) = 80 \times \frac{3}{4} = 60 > 5$



$$P(20 \leq X \leq 30) = \sum_{x=20}^{30} \binom{80}{x} \frac{1}{4}^{x} \frac{3}{4}^{80-x}$$

$P(X < 30) =$ $P\left(Z < \frac{30-20}{\sqrt{80 \times \frac{1}{4} \times \frac{3}{4}}}\right)$

R.V y : # of

$= P\left(Z < \frac{10}{\sqrt{15}}\right) = P(Z < 2.58) = 0.9951 - 0.5 =$

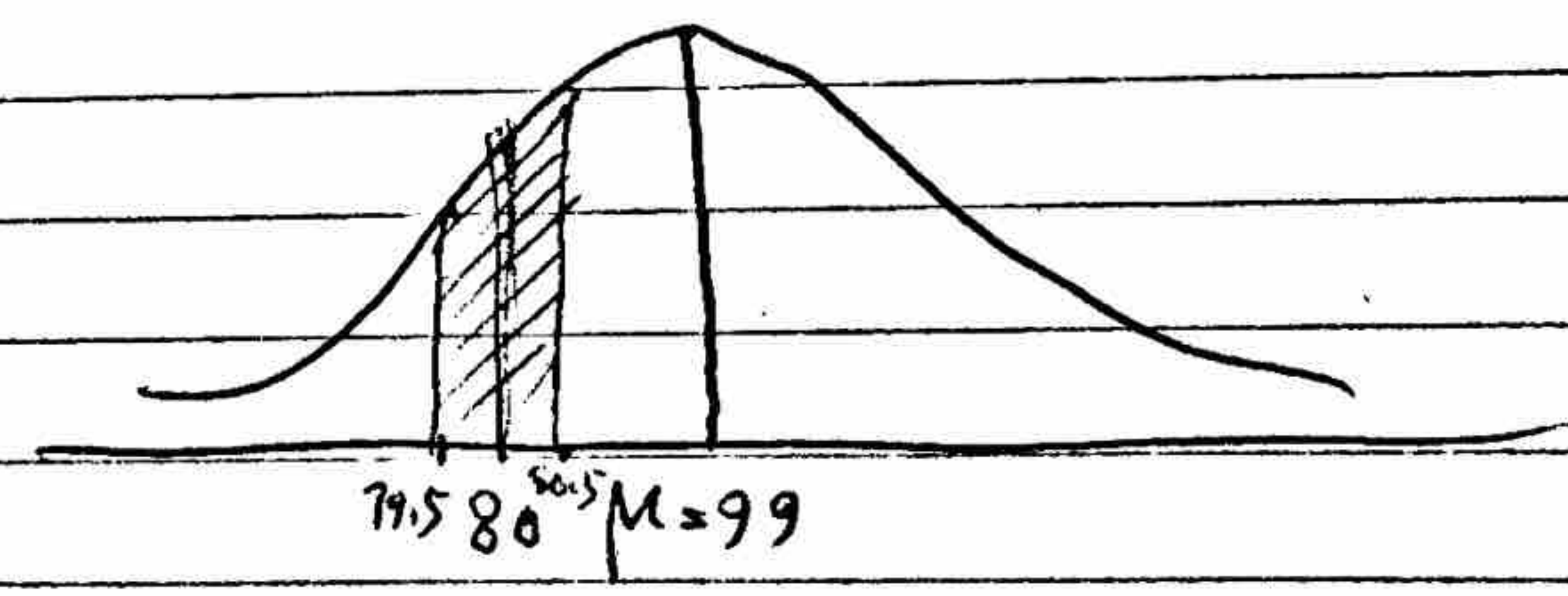
0.4951

$$\text{Prob} = \binom{200}{80} P^{80} \cdot Q^{200-80}.$$

$$\text{Prob} = \binom{200}{80} (0.4951)^{80} \cdot (1-0.4951)^{120}$$

~~Chance of Correct answers~~ $p = \frac{1}{4}$ $q = 1-p = \frac{3}{4}$

$\left(\frac{1}{4}\right)^{30}$



$\mu' = NP = 200 \times 0.4951 = 99.02$

$\sigma = \sqrt{NP(1-P)} = \sqrt{99.02(1-0.4951)} =$

$$P\left(\frac{79.5-99.02}{7.07} < Z < \frac{80.5-99.02}{7.07}\right) = P(2.61 < Z < 2.53)$$

$= 0.0057 - 0.0045$

$= 0.0012$

#6

R.V X: # of vowels in a ~~...~~ word $p = 0.2$

a) $P(X \geq 1) = 1 - P(X < 1) = 1 - P(X = 0) = 1 - (1-p)^3 =$

$= 1 - (1-0.2)^3 - 1 - (0.8)^3 = \underline{0.488}$

b) ~~R.V: # of vowels in a word~~

Y: # of words having at least one vowel: $p = 0.488$

$$P(Y \geq 12) = \sum_{y=12}^{20} \binom{20}{y} (0.488)^{y} \cdot (1-0.488)^{20-y}$$

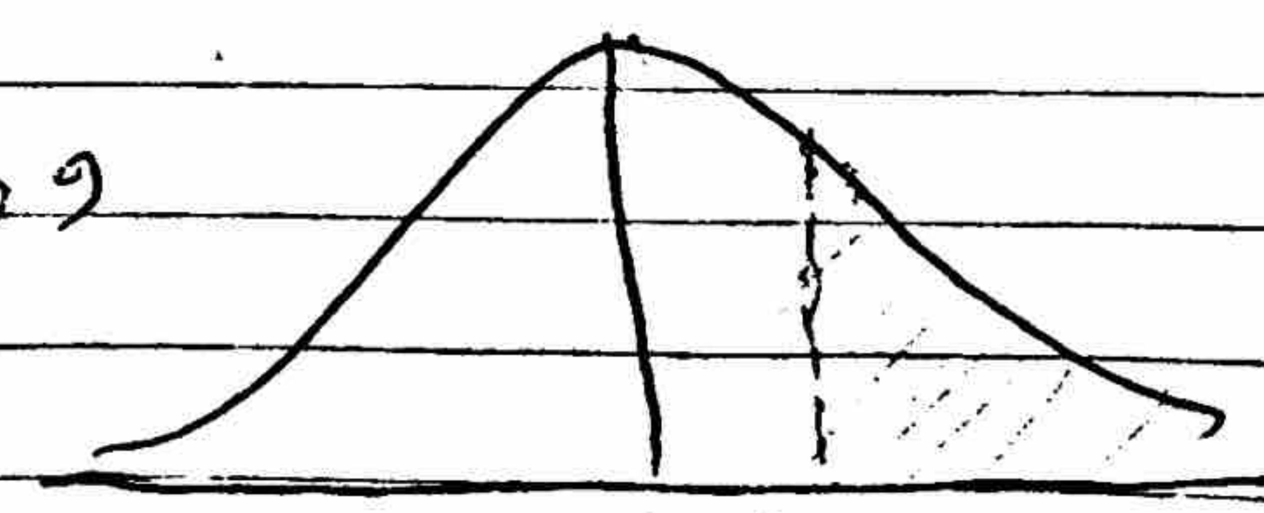
$= 0.1201 + 0.739 + 0.0370 + 0.0148 + 0.0046 +$
$0.001 + 0.0002 + 0.000 + 0.000$

Approximation

$n = 20 \quad p = 0.488 \quad \mu = np = 20 \times 0.488 = 9.76 > 5$

$n(1-p) = 20(1 - 0.488) = 10.24 > 5$

$$Z = \frac{(12 - 0.5) - 9.76}{\sqrt{9.76(1-0.488)}} = \frac{10.5240}{\sqrt{4.99}} = 4.709$$



$\mu = 9.76$

$P(Z > 4.709) \approx 0$ — almost certain that we would get less than 12 words out of 20 to have more than on vowel.

c) R.V. W: # of vowels in $20 \times 3 = 60$ letters $n = 60$

$$P(W \geq 12) = \sum_{w=12}^{60} \binom{60}{w} \cdot (0.2)^{w} \cdot (1-0.2)^{60-w}$$

#7

a) Total # of defective Parts = 12 + 10 = 22

$$P(\text{Good part}) = \frac{4000 - 22}{4000} = 0.9945$$

b) Total # of Complex parts = 1000 + 400 = 1400 = |C|

# of Good Complex parts = $|G \cap C| = 1400 - 16 = 1384$

$$P(\text{Good} \mid \text{Complex}) = \frac{P(G \cap C)}{P(C)} = \frac{1384}{1400} = 0.98857$$

#8

R : Event threat is Repoorted

T : Event Threat is present

$P(R|T) = 0.8$

$P(R'|T') = 0.9 \implies P(R|T') = 1 - (P(R'|T')) = 1 - 0.9$

$P(T) = 0.6$

a) $P(R) = P(R \cap T) + P(R \cap T')$

$= P(R|T) . P(T) + P(R|T') . P(T')$

$= 0.8 . 0.6 + (1 - 0.9)(1 - 0.6) = 0.52$

b) $P(T|R) = \dfrac{P(R|T) . P(T)}{P(R)} = \dfrac{0.8(0.6)}{0.52} = 0.923$

Given

c) $P(T) = 1 \quad P(R) = ?$

$P(R) = 0.8(1) + 0.9(0) = 0.8$

d) $P(R1 \cup R_2) = P(R1) + P(R_2) - P(R1 \cap R_2)$

$P(R1) = P(R) = P(R2) = 0.8$

$P(R1 \cup R2) = 0.8 + 0.8 - 0.8(0.8) = 1.6 - 0.64$

$= 0.96$