

MA311- Probability - Test #2

Professor Broughton

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Name: _____

Box # _____

Instructions

- Answer all the questions directly on the test.
- Show all the necessary work and write your answers out neatly in English sentences. Use mathematical notation to express your answers, not *Maple* notation
- It is not necessary to use your computer to answer all of the questions but you can use it to obtain graphs, evaluate functions, solve equations, etc. If you use *Maple* be sure to say so by some sentence such as: Using *Maple* the above integral equals
- Recall that you may use notes that you can fit on one standard sheet of paper. On your computer you may start off with one blank *Maple* worksheet only. Please hand in your sheet of notes with your test.

Question	Points
1	
2	
3	
4	
Total	

- 1.a Two standard dice are thrown. Compute the probability distribution X of the sum of the die faces.

x											
$P(X = x)$											

- 1.b Compute the mean μ and the standard deviation σ of X .

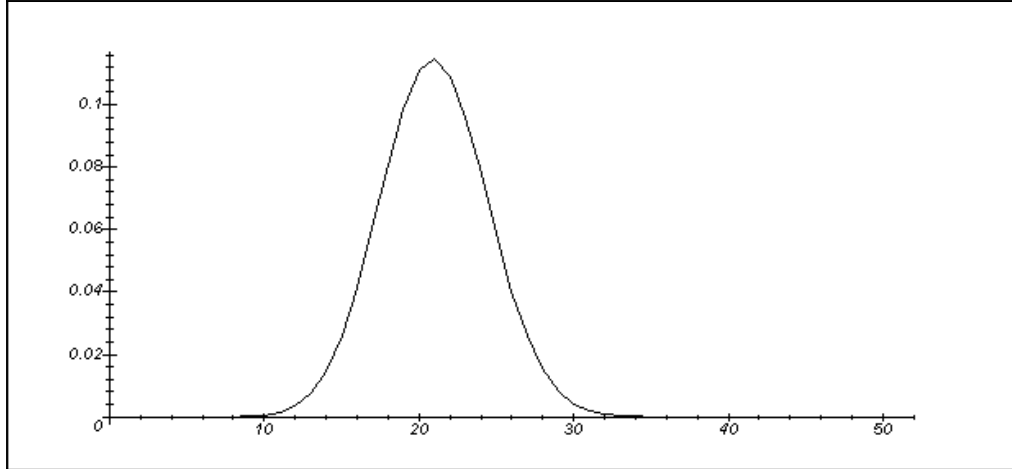
- 2 The random variable X has a binomial distribution with parameters $n = 50$ and $p = 0.4$. The graph of the probability distribution function is shown on the next page.

- 2.a Determine the mean μ and the standard deviation σ as numerical values.

- 2.b Mark on the graph below the following regions:

$$A : |X - \mu| \leq 2\sigma,$$

$$B : |X - \mu| > 3\sigma$$



2.c From Tchebycheff's inequality, complete the following statements.

$$P(A) = P(|X - \mu| \leq 2\sigma) \geq \text{---}$$

$$P(B) = P(|X - \mu| > 3\sigma) \leq \text{---}$$

2.d Either by estimation from the graph or by direct calculation with Maple, get a better estimate of the above probabilities. If you estimate from the graph write down the exact probability in terms of a sum or sums.

$$P(A) = \text{---}$$

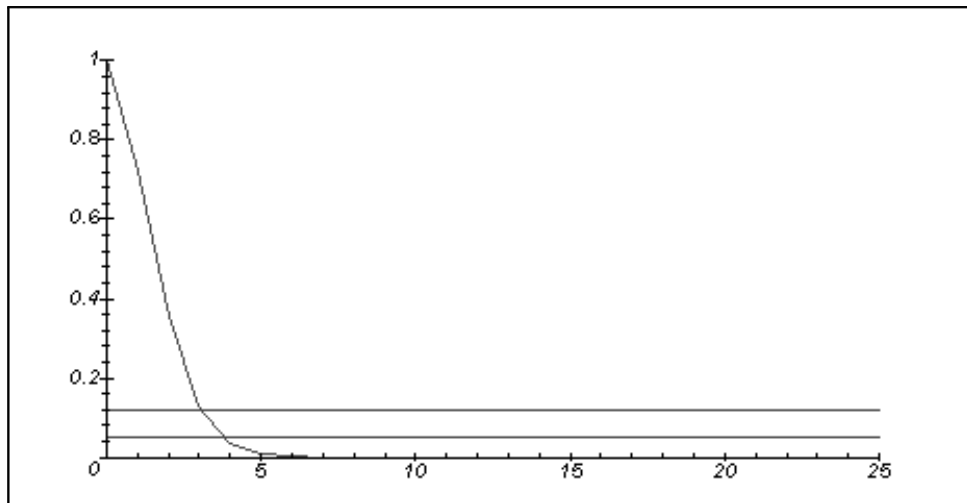
$$P(B) = \text{---}$$

2.e Are the estimates given by Tchebycheff's inequality in 2.c consistent with the calculations in 2.d?

3 Dr. Tom Roper, cornered in the bathroom by a Thorn reporter, says that number of laptops under repair at any one time is 2%-3% and certainly less than 5%. Thinking that the percentage might be larger than 5% reporter decides to do a sample survey of his math class of 25 students. The reporter decides to use a significance level of 0.5.

3.a Suppose that there were 6 laptops in the class that needed repair. What probability would you need calculate to decide whether you would accept or reject Dr Roper's contention that the percentage under repair is 5%.

3.b The reporter prepared the following "alpha" curve for the 5% hypothesis.



What critical regions should be selected for a 5% significance level and a 12% significance level.

3.c The class consist mostly of juniors with Soundwave computers. Does this pose any problems in the validity of the survey?

4 Two students have the following study habits. Student A carefully works problems of a given type until he/she gets one right. Student B works problems of the same type quickly until he/she gets two problems right (they look up the answers in the back of the book). Student A spends about 30 minutes per problem and has a success rate of 90%, Student B spends 20 minutes per problem with a success rate of 75%.

4.a Write out the probability distributions for the number of problems worked student *A* and student *B*.

4.b Determine the average number of problems worked by both students and who spends more time working the problems