



MTH4106

Introduction to Statistics

Test 2

30 March 2012, 1410–1450

Write your name and student number in the spaces below.

Answer all questions. Write all your answers in the boxes provided.

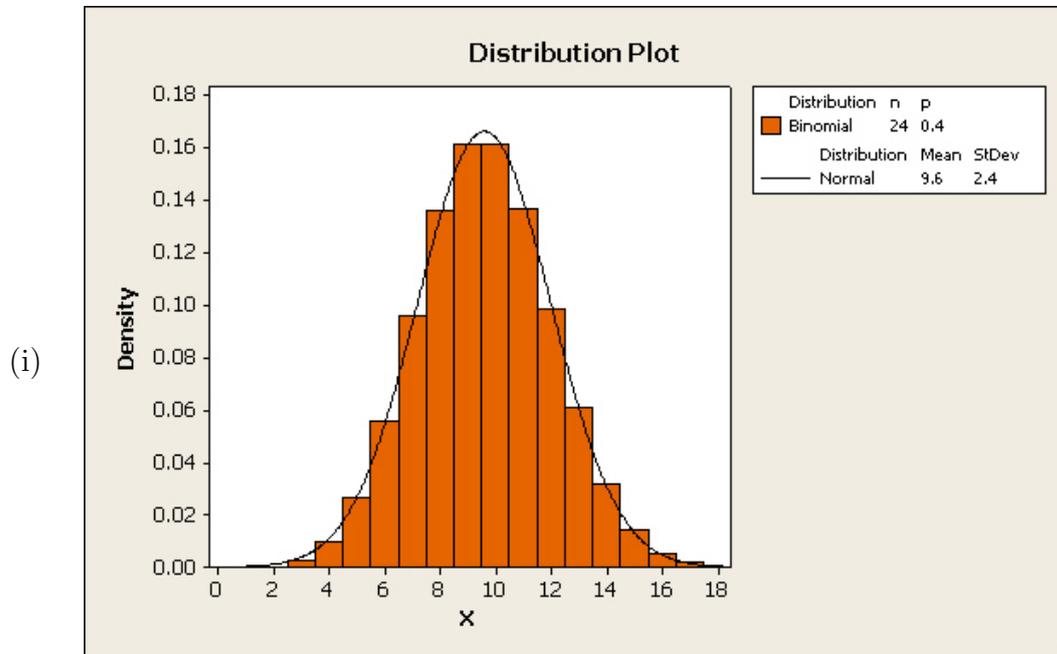
Name: _____

Student Number: _____

Electronic calculators may be used. Please state here the make and type of machine used.

Note that there is an extract from the *New Cambridge Statistical Tables* on the last two pages of this test.

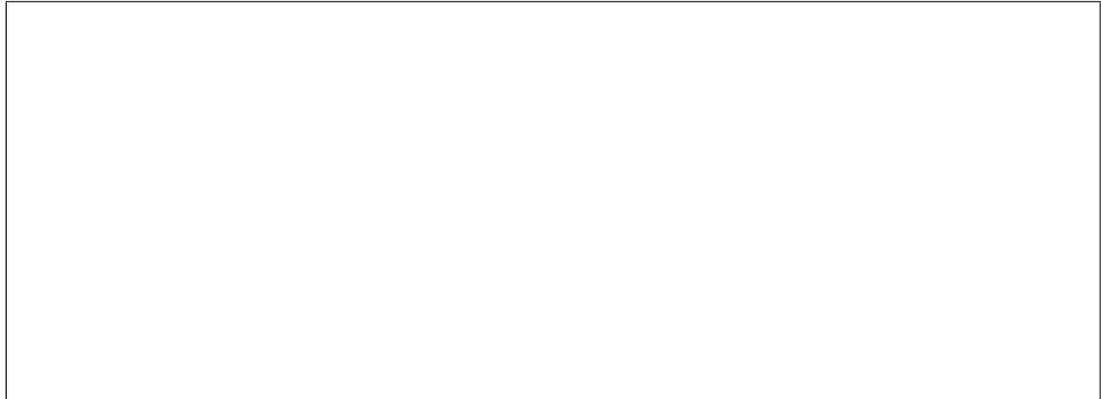
1 (20 marks) The figure below shows a graph produced with Minitab.



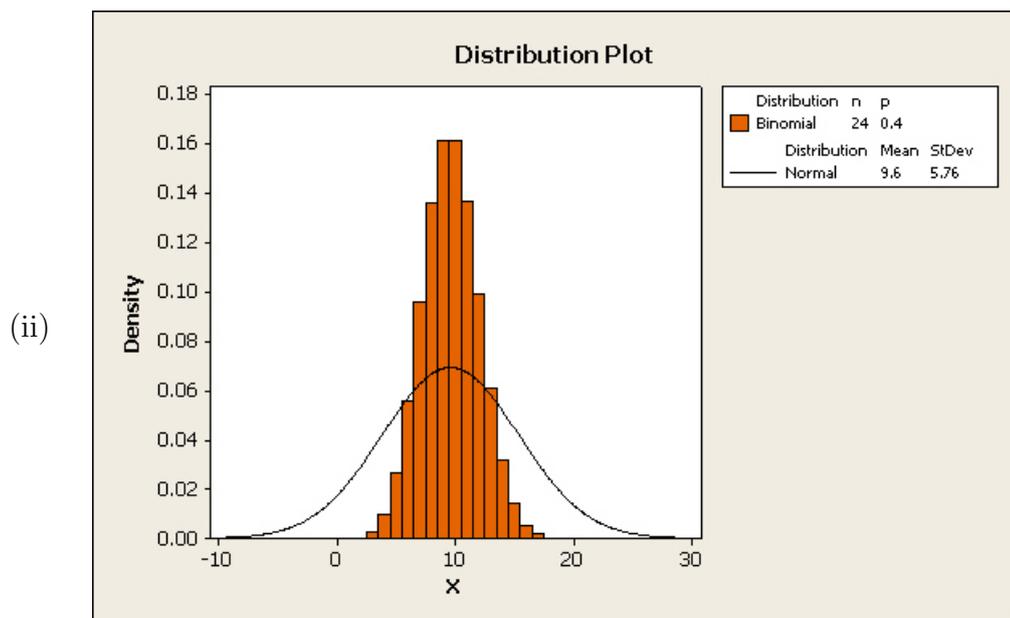
(a) What has been plotted on graph (i)?

Blank area for the answer to question (a).

(b) What theory does graph (i) demonstrate?



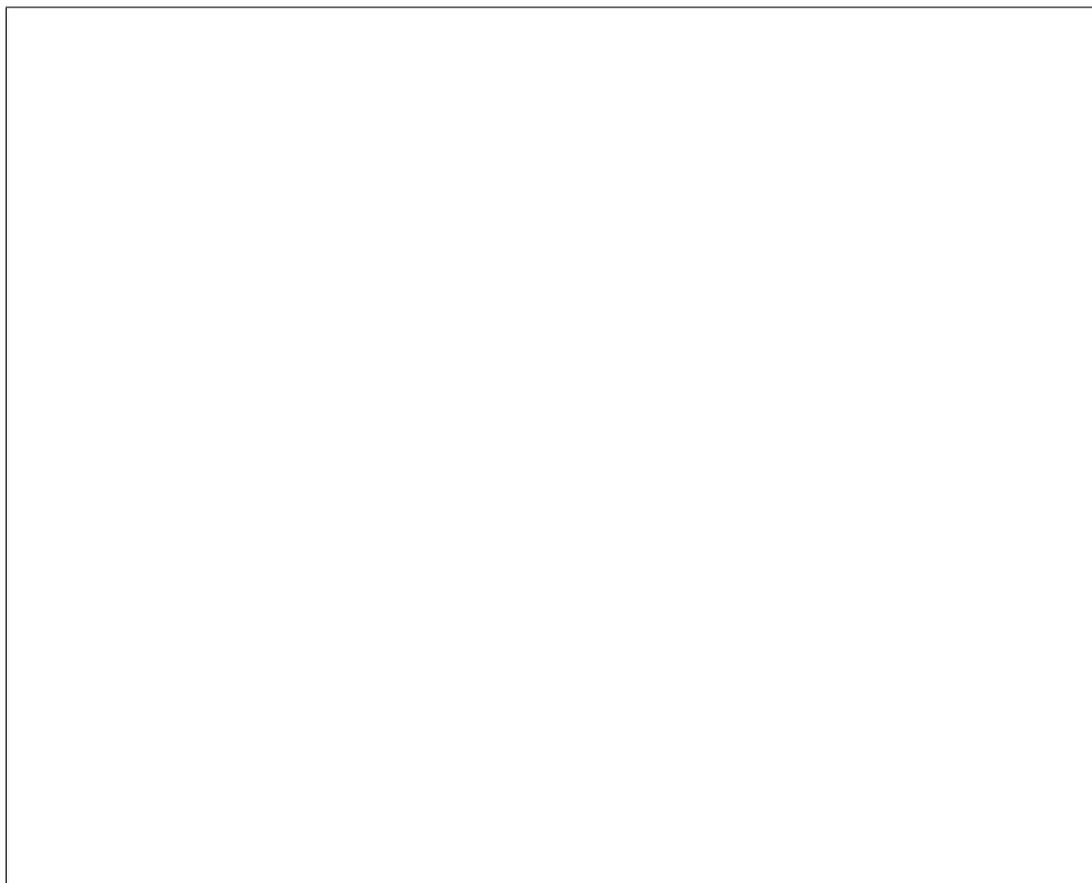
(c) One student produced graph (ii) shown below. What mistake did she make?



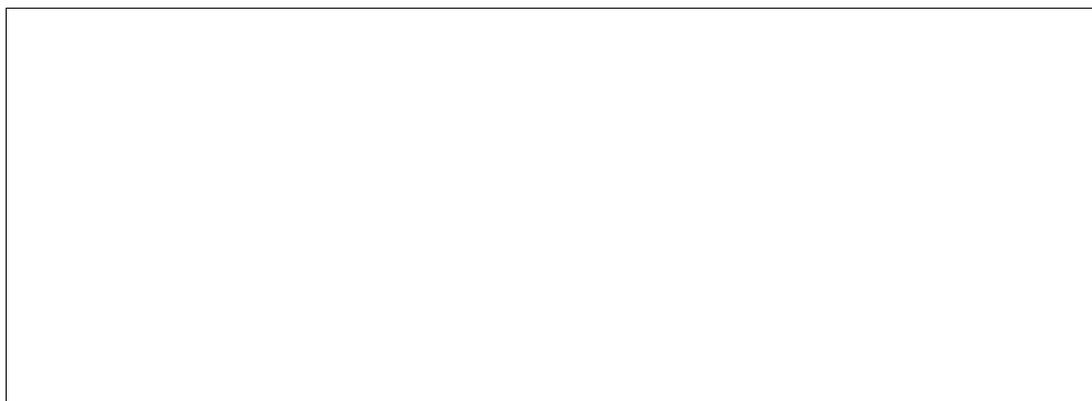
2 (25 marks) Let X_1, X_2, \dots, X_n be mutually independent random variables from the same distribution with mean μ and variance σ^2 . Put

$$T = \sum_{i=1}^n X_i \quad \text{and} \quad \bar{X} = \frac{T}{n}.$$

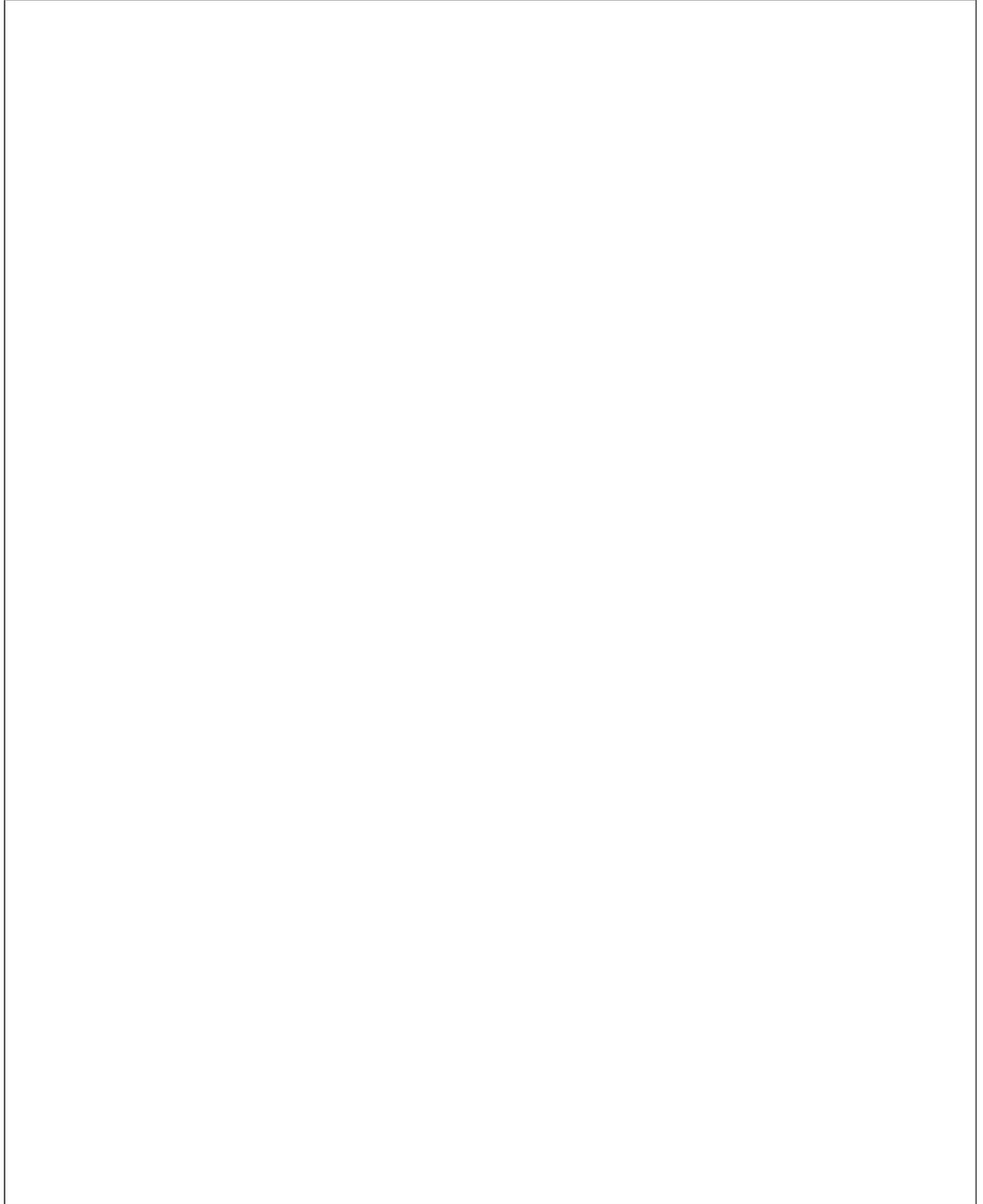
(a) Prove that $\mathbb{E}(T) = n\mu$ and $\mathbb{E}(\bar{X}) = \mu$.



(b) State the variance of \bar{X} .



(c) Prove the result stated in (b).



3 (25 marks) Suppose that 64% of women in the UK gamble at least once a year. A survey company asks a random sample of 900 women in the UK if they have gambled during the last year. Let X be the number who answer “yes”.
Find $\mathbb{P}(X \geq 600)$.

4 (30 marks) Production of peanuts from farms in Virginia usually averages 3000 pounds per acre. A company introduces a new fertilizer designed for peanut plants, and tests it on 70 separate plots of land. The mean yield (in pounds per acre) on these plots is 3120, with a sample standard deviation of 578.

The company claims that the fertilizer improves the yield of peanuts. Let μ be the true mean yield of the new fertilizer. As the company's statistician, your null hypothesis is $H_0 : \mu \leq 3000$ and your alternative hypothesis is $H_1 : \mu > 3000$.

Perform a hypothesis test at the 5% significance level; report your conclusions.