

**University of Technology Sydney**  
**School of Mathematical and Physical Sciences**

Probability and Random Variables (37161) –  
Class 4 Preparation Work

1. For each of the following variables, state whether they could reasonably be modelled by a Bernoulli variable, a Binomial variable or a Geometric variable. In each case, state the parameter(s) needed. (In some cases, you will know the numerical value of these parameters, in others it might simply be, for example “the proportion of people in Category X”)

Where none of these distributions are appropriate, briefly explain why not.

- i) Of one randomly selected individual from the country's population, the number of people called Bob.
- ii) The number of times a person takes his/her driving test, assuming that he/she is equally likely to pass any given time.
- iii) The number of times a card is selected from a deck until the first Ace is chosen, assuming cards are not returned to the deck after selection.
- iv) From a randomly chosen selection of 10 people from the country's population, the number of males selected.
- v) Of a family of 5 people, the number who watched a given television program the previous night.
- vi) The number of customers who arrive into a shopping centre during a 1 hour period.
- viii) In a single turn of 10-pin bowling, the number of pins a bowler knocks down.
- ix) In a single turn of 10-pin bowling, the number of times a bowler knocks down at least one pin.
- x) From 6 independent draws from a random number generator which produces integer values between 1 and 1000 inclusively, the number of draws whose final digit is 0.

2. Let  $X \sim \text{Bin}(7, 0.2)$ .

Calculate:

- i)  $P(X = 0)$
- ii)  $P(X = 4)$
- iii)  $P(X = 10)$
- iv)  $E(X)$
- v)  $\text{Var}(X)$

Hint: for iv) and v) you may wish to consider the relationship between Bernoulli variables and related Binomial variables.

3. Let  $Y \sim \text{Geo}(0.7)$ .

Calculate:

- i)  $P(Y = 0)$
- ii)  $P(Y = 4)$
- iii)  $P(Y > 1)$
- iv)  $P(Y > 15)$ .

4. Let  $z_1, z_2, \dots, z_{20} = 0, 0, 0, 1, 0, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0, 1, 0, 0, 1$  be 20 independent realisations of  $Z \sim \text{Bern}(0.3)$ .

- i) Using the realisations sequentially in sets of five (i.e.  $z_1, \dots, z_5$  then  $z_6, \dots, z_{10}$  etc.) generate 4 independent realisations of  $N \sim \text{Bin}(5, 0.3)$ .
- ii) Using the realisations sequentially starting from  $z_1$  (and working along the list) generate independent realisations of  $G \sim \text{Geo}(0.3)$ .