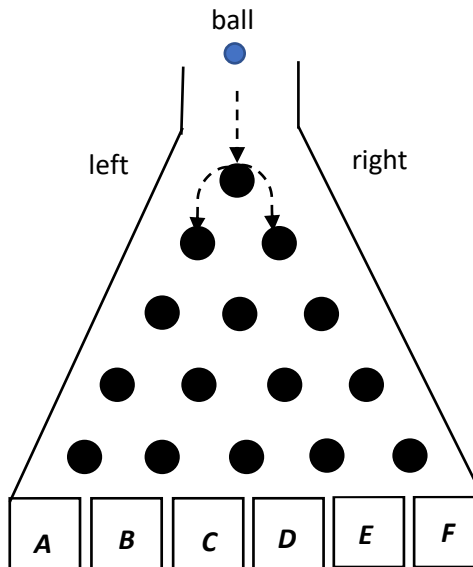


Revision Timed Practice for DRV, Binomial, Geometric, Poisson (2 questions, 25 marks, 45 minutes)

- 1 In the game of Plinko at a funfair, a ball is dropped down a chute riddled with pegs. When it hits a peg, it has a chance of falling to the left or to the right. It then proceeds down to another row of pegs, hitting one of them only and falling left or right to the next row. The game will stop when the ball landed in one of the slots at the bottom of the chute. The diagram below shows a plinko board with 5 rows and 6 slots; A , B , C , D , E and F .



Given that each peg in the plinko has been “fixed” such that the probability of the ball falling to the left after hitting each peg is 0.7 and the probability of the ball falling to the right after hitting each peg is 0.3.

- (i) Show that the probability of a ball landing in slot D is 0.1323. [1]
- (ii) Balls are dropped in succession until one ball lands in slot D . The probability that at least n balls are needed is at least 0.5. Find the largest value of n . [3]

Suppose a small gift and a mystery gift will be won if a ball landed in slot E and F respectively. On average, 2.835 small gifts and 0.243 mystery gifts were won per day at a funfair. Let S and M be the number of small gifts and mystery gifts, won per day, respectively.

- (iii) State in context, two assumptions needed for S and M to be well modelled by Poisson distributions. [2]

Assume now that S and M follow independent Poisson distributions,

- (iv) find the largest integer n such that the probability of total number of gifts won in n days is more than 100 is at most 0.2. [3]
- (v) find the probability that in a 7-day period, there are at least 15 small gifts won given that the total number gifts won is less than 18. [3]

2 Christopher plays a computer game with Yi Han, where they each shoot at a target. For each shot, the probability that Christopher and Yi Han hitting the target is 0.25 and 0.35 respectively. This is independent of all other shots for both players and they each take turns to shoot with Christopher starting first. Find the

- (i) most likely number of shots, out of 20 shots attempted, that hit the target for Christopher, [2]
- (ii) probability that, out of 20 shots attempted, Yi Han hits the target at least five times given that he hits the target only at most ten times, [3]
- (iii) probability that Christopher and Yi Han take the same number of shots to hit the target and [3]
- (iv) probability that Christopher needed more than twice the number of shots than Yi Han to hit the target. [3]

To make things more exciting, Christopher and Yi Han decides to place a wager on the game. If Christopher needed more than twice the number of shots than Yi Han to hit the target, Christopher pays Yi Han \$10. If Christopher and Yi Han used the same number of shots Christopher receives \$5 from Yi Han. If neither of the two cases, Yi Han win \$2 from Christopher. Find the expected winning of Christopher after 10 games. [2]