## Questions

1. Raindrops are falling at the rate of 1 drop per second. Let $p$ be the probability of getting more than 120 raindrops within a minute.
(a) Use Markov's inequality to argue that $p \leq 50 \%$.
(b) Use Chebyshev's inequality to argue that $p \leq 2 \%$.
(c) Estimate $p$ using the Central Limit Theorem.
2. Alice is mailing letters to solicit donations from CUHK alums. From past experience she knows that $30 \%$ of the alums make a 500 dollar donation and $10 \%$ of the alums make a 1,000 dollar donation. She needs to mail enough letters to collect 50,000 dollars. Use the Central Limit Theorem to estimate
(a) the probability she meets her target by mailing 180 letters.
(b) the number of letters she has to mail to meet her target with $90 \%$ probability.
3. The following exam statistics are posted on the course website:

| section | no. students | average grade | std. dev. |
| :--- | :--- | :--- | :--- |
| A | 30 | 65 | 5 |
| B | 20 | 70 | 10 |

what can you say about the number of students whose exam grade was 30 or below?
Estimate the quantity of your interest using (a) Markov's inequality, (b) Chebyshev's inequality and (c) the Central Limit Theorem. Explain the assumptions you are making about the probability model (if any).
4. There are 6 computers. Every pair of computers connects with probability $10 \%$, independently of the other pairs. Say a computer is isolated if it didn't connect to any of the other computers. Let $N$ be the number of isolated computers.
(a) Calculate the expected value of $N$.
(b) Calculate the variance of $N$.
(c) Argue that the probability that at least one computer is isolated is $70 \%$ or more.

