25 students in class
60% accuracy model

4a) 3 models & build majority vote classifier C_3, what would be accuracy of new classifier?

$$P = \binom{n}{k} p^k (1-p)^{n-k}$$

$n = 3$
$k = 2$
$p = 0.6$

need to consider majority vote at least 2 of 3

$$P = \binom{3}{2}(0.6)^2(1-0.6)^{3-2} + \binom{3}{3}(0.6)^3$$

$$\frac{3 \cdot \cancel{2} \cdot \cancel{1}}{(\cancel{2} \cdot \cancel{1}) \cdot 1}(0.36)(0.4) + \cancel{\frac{3 \cdot 2 \cdot 1}{(3 \cdot 2 \cdot 1) \cdot 1}}(0.216)$$

$$(3)(0.36)(0.4) + 0.216$$

$$0.432 + 0.216$$

$$0.648 \longrightarrow 64.8\%$$

4b) 5 models & build majority vote classifier C_5, what would be accuracy of new classifier

$n = 5$
$k = 3$
$p = 0.6$

need to consider majority vote at least 3 of 5

$$P = \binom{5}{3}(0.6)^3(1-0.6)^{5-3} + \binom{5}{4}(0.6)^4(1-0.6)^{5-4} + \binom{5}{5}(0.6)^5$$

$$(5 \cdot 2)\ \cancel{\frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{(3 \cdot 2 \cdot 1)(2 \cdot 1)}}(0.216)(0.16) + (5)\cancel{\frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{(4 \cdot 3 \cdot 2 \cdot 1) \cdot 1}}(0.1296)(0.4) + \cancel{\frac{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 1}}(0.07776)$$

$$0.3456 + 0.2592 + 0.07776$$

$$= 0.68256 \longrightarrow 68.3\%$$

4c) Provided a program to calculate this. The output yielded was 0.8462 or 84.6%

4d) The calculations in part c assume that all models are independent and have identical accuracy rates across diverse conditions. This does not hold in reality for the following reasons:

1) Models can be correlated, if they are trained on the same dataset or share similar features, algorithms or hyperparameters

2) The performance of models can vary significantly across different segments of data or under different conditions, which is not captured in a single accuracy metric

3) The assumption of a constant accuracy rate such as that of 60% across all possible inputs is overly simplistic as real world data often exhibits more complexity & variability

4e) Again I used the program from part c to calculate this. The output yielded was 0.3063 or 30.6 %