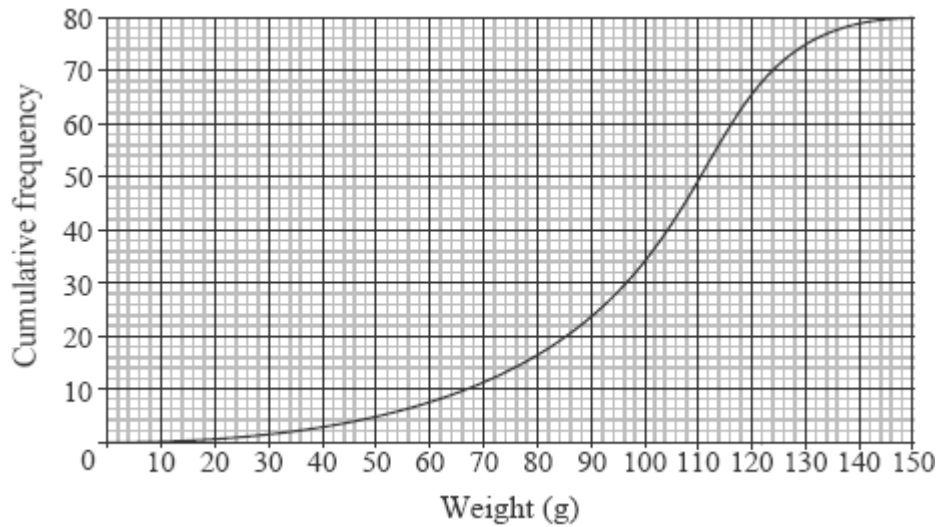


1. The cumulative frequency graph below represents the weight in grams of 80 apples picked from a particular tree.



- (a) Estimate the
- (i) median weight of the apples;
 - (ii) 30th percentile of the weight of the apples.
- (2)
- (b) Estimate the number of apples that weigh more than 110 grams.
- (2)
- (Total 4 marks)**

2. Port A is defined to be the origin of a set of coordinate axes and port B is located at the point (70, 30), where distances are measured in kilometres. A ship S_1 sails from port A at 10:00 in a straight line such that its position t hours after 10:00 is given by $\mathbf{r} = t \begin{pmatrix} 10 \\ 20 \end{pmatrix}$.

A speedboat S_2 is capable of three times the speed of S_1 and is to meet S_1 by travelling the shortest possible distance. What is the latest time that S_2 can leave port B?

(Total 7 marks)

3. A triangle has vertices $A(1, -1, 1)$, $B(1, 1, 0)$ and $C(-1, 1, -1)$.

Show that the area of the triangle is $\sqrt{6}$.

(Total 6 marks)

4. In a population of rabbits, 1 % are known to have a particular disease. A test is developed for the disease that gives a positive result for a rabbit that **does** have the disease in 99 % of cases. It is also known that the test gives a positive result for a rabbit that **does not** have the disease in 0.1 % of cases. A rabbit is chosen at random from the population.

(a) Find the probability that the rabbit tests positive for the disease.

(2)

(b) Given that the rabbit tests positive for the disease, show that the probability that the rabbit does not have the disease is less than 10 %.

(3)

(Total 5 marks)

5. The complete graph H has the following cost adjacency matrix.

	A	B	C	D	E
A	–	19	17	10	15
B	19	–	11	16	13
C	17	11	–	14	13
D	10	16	14	–	18
E	15	13	13	18	–

Consider the travelling salesman problem for H .

(a) By first finding a minimum spanning tree on the subgraph of H formed by deleting vertex A and all edges connected to A, find a lower bound for this problem.

(5)

(b) Find the total weight of the cycle ADCBEA.

(1)

(c) What do you conclude from your results?

(1)

(Total 7 marks)

6. The number of accidents that occur at a large factory can be modelled by a Poisson distribution with a mean of 0.5 accidents per month.
- (a) Find the probability that no accidents occur in a given month. (1)
- (b) Find the probability that no accidents occur in a given 6 month period. (2)
- (c) Find the length of time, in complete months, for which the probability that at least 1 accident occurs is greater than 0.99. (6)
- (d) To encourage safety the factory pays a bonus of \$1000 into a fund for workers if no accidents occur in any given month, a bonus of \$500 if 1 or 2 accidents occur and no bonus if more than 2 accidents occur in the month.
- (i) Calculate the expected amount that the company will pay in bonuses each month.
- (ii) Find the probability that in a given 3 month period the company pays a total of exactly \$2000 in bonuses.

(9)

(Total 18 marks)