Godalming College

Statistics 1 – Normal distribution (finding μ and σ)

Please **complete** this homework by _____. Start it early. If you can't do a question you will then have time to ask your teacher for help or go to a drop-in session.

Section 1 – Review of previous topics. Please complete all questions.

1. a) Use the percentage points table to find a value of z such that $P(Z < z) = 0.025$
   b) A running club select the fastest 2.5% of members from a race to take part in another race. Given that the times can be modelled by a normal distribution with mean 70 and standard deviation 4.5, use your answer to part a) to determine the time necessary to get through to the next race.

2. A meteorologist believes that there is a positive correlation between daily mean windspeed and daily maximum gust. She collects data from the large data set for 5 days during August 2015 in the town of Hurn.

Mean windspeed (knots)	5	7	8	8	6
Daily maximimum gust (knots)	17	21	20	23	16

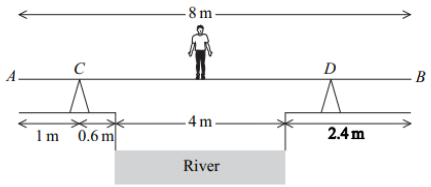
   By Calculating the product moment correlation coefficient for these data, test at the 5% level of significance, whether there is evidence to support the meteoroligist's claim. State your hypothesis clearly

3. A survey of the reading habits of some students revealed that, on a regular basis, 25% read quality newspapers, 45% read tabloid newspapers and 40% do not read newspapers at all.
   a) Find the proportion of students who read both quality and tabloid newspapers.
   b) Draw a Venn diagram to represent this information.

   A student is selected at random. Given that this student reads newspapers on a regular basis,

   c) Find the probability that this student only reads quality newspapers.

4. Ken is trying to cross a river of width 4m. He has a uniform plank, AB, of length 8m and mass 17kg, modelled as a rod. The ground on both edges of the river bank is horizontal. The plank rests at two points, C and D, on fixed supporst which are on opposite sides of the river. The plank is at right angles to both river banks and is horizontal. The distance AC is 1m, and the point C is at a horizontal distance of 0.6m from the river bank. Ken, who has a mass of 65kg, stands on the plank directly above the middle of the river, as shown in the diagram.



a) Draw a diagram to show the forces acting on the plank.
b) Given that the reaction on the plank at D is 44gN, find the horizontal distance of the point D from the nearest river bank.
c) State how you have used the fact that the plank is uniform in your solution.
d) State how you have used the fact that the plank is modelled as a rod in your solution

Section 2 – Consolidation of this week's topic. Please complete all questions.

1. a) Explain briefly what is meant by a statistical model *(1 mark)*
b) State whether you might use the normal distribution to model the following. Give reasons for your decisions.
i) The time taken by a bus over the same route at the same time each day.
ii) The number of new year 7 pupils each year in a school.
(4 marks)

2. The random variable $X \sim N(\mu, 7^2)$ and $P(X < 24) = 0.8106$. Find the value of μ.
(2 marks)

3. The random variable $Y \sim N(30, \sigma^2)$ and $P(Y > 36) = 0.0307$ Find the value of σ.
(2 marks)

4. The random variable $S \sim N(8.7, \sigma^2)$. Given that $P(S > 3a) = 0.0668$ and $P(S < a) = 0.0163$, find the value of σ and the value of a.
(5 Marks)

5. The life of a light bulb can be modelled by a normal distribution with standard deviation of 18 hours. 10.2% of the light bulbs last longer than 810 hours. What is the mean of the distribution to the nearest hour?
(2 marks)

6. The weight of honey put into each jar by a machine in normally distributed with a standard deviation of 1.6g. The machine operator can adjust the mean weight of the honey put into each jar without changing the standard deviation.

   Find, correct to 4 significant figures, the minimum that the mean weight can be set to such that at most 1 in 20 of the jars will contain less than 454g. *(3 marks)*

7. A call-centre dealing with complaints collected data on how long customers had to wait before an operator was free to take their call.

   The lower quartile of the data was 12.7 minutes and the interquartile range was 5.8 minutes.

   a) Find the value of the upper quartile of the data. *(1mark)*

   It is suggested that a normal distribution could be used to model the waiting time.

   b) Calculate, correct to 3 significant figures, the mean and variance of this normal distribution based on the values of the quartiles. *(5 marks)*

   The actual mean and variance of the data were 15.3 minutes and 20.1 minutes respectively.

   c) Comment on the suitability of the model. *(2 marks)*

8. The time taken by workers at a factory to travel to work each day may be taken as normally distributed. 2% of workers take less than 10 minutes to travel to work and 10% of workers take at least 50 minutes.
   a) Sketch a diagram to represent this information *(2 marks)*
   b) Find the mean and standard deviation of the distribution of the times, giving your answers to 3.s.f. *(5 Marks)*

(Total 34 marks)