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1) **(10 Marks)** In a particular area, there are just three makes of cars available: Ford (60% of the total), Renault (30%) and Honda (10%). The carburetors on Fords have a 0.09 probability of failure, those on Renaults have a 0.05 chance and those on Hondas have a 0.02 chance of failure. If a car with a failed carburetor is selected at random, what is the probability that it is a Ford?

2) **(10 Marks)** A multiple-choice quiz has 200 questions each with 4 possible answers of which only 1 is the correct answer. What is the probability that sheer guesswork yields from 25 to 30 correct answers for 80 of the 200 problems about which the student has no knowledge? **[HINT: approximation may be helpful here]**

3) **(10 Marks)** Let X and Y represent two random variables whose joint density function is

$$f_{XY}(x,y) = \begin{cases} 24xy, & 0 \leq x \leq 1, 0 \leq y \leq 1, \quad x+y \leq 1 \\ 0, & \text{elsewhere} \end{cases}$$

   a) Find $f_Y(y)$.
   b) Are X and Y independent? Explain.
   c) Find $P\left(Y < \frac{1}{8} | X = \frac{3}{4}\right)$.

4) **(10 Marks)** Two independent experiments are being run in which two different types of paints are compared. Eighteen specimens are painted using type A and the drying time, in hours, is recorded on each. The same is done with type B.

   a) Suppose that the population standard deviations are both known to be 1.0. Assuming that the mean drying time is equal for the two types of paint, find $P(\bar{X}_A - \bar{X}_B > 1.0)$, where $\bar{X}_A$ and $\bar{X}_B$ are average drying times for samples of size $n_A = n_B = 18$.
   b) Repeat Part (a) when the population standard deviations are unknown, but they are still equal and estimated to be $s = 0.96$.

5) **(10 Marks)** A random sample of 100 automobile owners shows that, in the province of Quebec, an automobile is driven on the average $23,500$ kilometers per year with a standard deviation of 3900 kilometers.

   a) Construct a 99% confidence interval for the average number of kilometers an automobile is driven annually in Quebec.
   b) What can we assert with 99% confidence about the possible size of our error if we estimate the average number of kilometers driven by car in Quebec to be $23,500$ kilometers per year?

6) **(10 Marks)** The life in hours for a battery is known to be normally distributed with standard deviation $\sigma = 1$ hours. A random sample of 16 batteries has a mean life of $\bar{x} = 20.3$ hours.

   a) Test $H_0 : \mu = 20$ versus $H_1 : \mu > 20$ for $\alpha = 0.05$.
   b) What is the P-value of the test in part (a)?
   c) What is the β error for the test in part (a) if the true mean is 20.75 hours?