Assessment STA 4442 Probability and Statistics 1
Fall 2009

A "Calculus Preparedness Quiz" was given to the class (20 minutes) of 25 students. This is the frequency distribution of the result:

points	students
0	1
1	3
2	4
3	2
4	5
5	4
6	2
7	2
8	1
9	0
10	1

Only 6 of the 25 students (partially) solved more than half of the 5 questions (2 points were given for each correct question). Generously counting, we have at most 25% of the students satisfying the actual prerequisites

Three questions from the sample tests of the Actuary Society were embedded in the Final Exam of STA 4442 Probability and Statistics 1.

1. The first question covered probability of sets, and conditional probability.

   Outcome:

   16% got the answer completely right

   16% had some minor errors in deriving the answer

   40% translated correctly the given text information into probabilities and conditional probabilities, but did not apply conditioning to the final result.

   16% got some of the above set probabilities correct, but not all of them

   12% did not produce any result on this question.

   Assessment: Surprising is the large percentage (40%) of students who did not apply the "Law of total probability". Overall, this problem got the best results of the three assessment problems.

2. The second question tests the knowledge of students regarding general aspects of distributions. They had to correctly

   (a) identify that the given distribution is continuous

   (b) transform the distribution

   (c) find the density function of the transformed distribution

   12% basically got the right answer to (c)

   12% got (b) right

   The remainder failed.

   Assessment: This problem needs technical skills. Because of the low level of Calculus skills in the class, the outcome of such problems can not be expected to be better.

3. The third questions needs bivariate distribution skills. Given the marginal density of one, and the conditional density of the other variable, students had to find the joint density and the expectations of both, and finally calculate the covariance.

   20% basically got the right answer

   8% got some of the preliminary steps right

   The remainder failed.

   Assessment: The problem is greatly simplified by the simplicity of the distributions, which makes detailed calculations unnecessary. This was not seen by the students, and can not be expected from a class that struggles with basic definitions. If homework would be done as intended (and not just copied), the outcome to this questions would be much better.

Appendix:

Prob&Stats 1 Quiz 0 Name: 8/28/09

1. Find the value of the constant c such that $\int_0^1 ce^x dx = 1$

2. Find
$$\frac{d}{dx}\int_0^x e^{-t^3} dt$$

3. Find the value of $\sum_{n=1}^{\infty} \frac{8}{3^{2n}}$

4. Find the value of $\sum_{m=0}^{\infty} 9^{-m}/m!$.

5. Where on the real axis is X defined, if $|X - 6| > 2$?

The Actuary Exam questions:

1. A doctor is studying the relationship between blood pressure and heartbeat abnormalities in her patients. She tests a random sample of her patients and notes their blood pressures (high, low, or normal) and their heartbeats (regular or irregular). She finds that:

   (i) 15% have high blood pressure,

   (ii) 21% have low blood pressure,

   (iii) 18% have an irregular heartbeat.

   (iv) Of those with an irregular heartbeat, one-third have high blood pressure.

   (v) Of those with normal blood pressure, one-eighth have an irregular heartbeat.

   What portion of the patients selected have a regular heartbeat and low blood pressure?

2. The time, T, that a manufacturing system is out of operation has cumulative distribution function
$$F(t) = \begin{cases} 1 - \left(\frac{3}{t}\right)^2 & \text{for } t > 3 \\ 0 & \text{elsewhere} \end{cases}$$
   The resulting cost to the company is $Y = T^2$. Determine the density function (p.d.f) of Y, for $y > 9$.

3. Let X and Y denote the values of two stocks at the end of a five-year period. X is uniformly distributed on the interval $(0, 10)$. Given $X = x$, Y is uniformly distributed on the interval $(0, x)$. Find $Cov(X, Y)$.