

# Academic Consulting:

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# Primary Mission I

- ▶ Article 33 of the APUO agreement stipulates that
- ▶ a member must notify the dean in advance and in writing.
- ▶ The dean shall determine whether such activity is in conflict with the members obligations.
- ▶ In practice up to 20% of one's time may be devoted to consulting when the project is related to one's academic expertise.
- ▶ In practice the university has been supportive of consulting activities.

# Primary Mission II

- ▶ Since my primary mission is academic and since
- ▶ my marginal tax rate is over 50%
- ▶ *I don't do number crunching.*
- ▶ Any consulting job I take must have a research component.

- ▶ One year at Nortel as an NSERC Industrial Fellow
- ▶ working in the future networks group.
- ▶ One of the best programs NSERC ever developed for generating academic-industry collaboration.
- ▶ Unfortunately cancelled in the late 90's.

- ▶ Consulted on the overload of switching buffers.
- ▶ Resulted in a research article.
- ▶ Newbridge hired the M.Sc. student involved in the project.
- ▶ A second project involved minimizing jitter in TDMA traffic carried over a packet network.
- ▶ The project resulted in a research article and a patent.

- ▶ An informal project to describe TPC connections developed with Nortel engineers.
- ▶ No funding ever came through from Nortel but
- ▶ the project resulted in a mean field analysis of TCP, multiple research articles.
- ▶ Best of all I carried out this work with the TREC group in Paris.

- ▶ Currently am consulting on calculating the small quantiles of a failure time involving many random inputs.
- ▶ The failure time  $T$  is a deterministic function  $g$  of stochastic inputs  $(X_1, X_2, \dots, X_r)$ ; i.e.  $T = g(X_1, X_2, \dots, X_r)$ .
- ▶ The inputs are assumed independent and their densities  $(f_1, f_2, \dots, f_r)$  are specified.
- ▶ The function  $g(x_1, \dots, x_r)$  may be computationally complex. In fact it is a sequential procedure based on the stress histogram.
- ▶ It is monotonic in each variable.
- ▶ We wish to estimate the failure probability  $F(t) = P(T \leq t)$  especially in the region when  $F(t) < \alpha$
- ▶ where  $\alpha$  is a given *small* probability.
- ▶ Analytically

$$F(t) = \int_{(x_1, \dots, x_r): g(x_1, \dots, x_r) \leq t} f_1(x_1) \cdots f_n(x_r) dx_1 \cdots dx_r.$$

- ▶ We used importance sampling - a method of generating twisted variables  $(\tilde{X}_1, \tilde{X}_2, \dots, \tilde{X}_r)$
- ▶ such that  $g(\tilde{X}_1, \tilde{X}_2, \dots, \tilde{X}_r)$  is more likely to fall to the left of the  $\alpha$  quantile.
- ▶ We were lead to a new method of doing importance sampling.
- ▶ The company has hired one of our students to train to become an in-house statistician.
- ▶ He will do a Ph.D. related to one of their engineering projects.

# Industrial Consulting is Chaotic

- ▶ Don't expect a long term relationship.
- ▶ Nevertheless it is very worthwhile for generating research ideas.
- ▶ The company may hire your students.

- ▶ We have only 15 or so undergraduates studying statistics.
- ▶ Many are in the co-op program.
- ▶ We the same number of graduate students in statistics.