Second Year Project

**Supervisor: Prof. AT Walden**
**The Distribution of the Extreme from a Normal Sample**

The project is primarily about the distribution of the maximum from a sample $X_1$, $\ldots, X_N$ of iid random variables as $N \to \infty$, with special emphasis on the normal distribution.

The extreme value theory associated with this problem has great relevance to risks involving extremes in meteorology, seismology, oceanography etc, where specific problems might include the greatest wave heights expected to be encountered by a North Sea oil rig, or the maximum temperature at a location. It is also highly relevant to the insurance industry.

Fisher and Tippett (1928) proved that under certain conditions the distribution of the maximum of a sample would converge to one of three types of (extreme-value) distribution. These three types were later unified into one generalized extreme-value distribution having a shape parameter $k$. If the sample has a normal distribution, then the corresponding extreme distribution corresponds to $k = 0$, and is given the name of the Gumbel distribution. (The other two cases correspond to $k < 0$ and $k > 0$).

The project should begin by studying these results, and move on to considering parameter estimation for the Gumbel and generalized extreme-value distributions. Goodness of fit can be considered using graphical and other methods. Application to some real data, with careful analysis of results, should be an important part of the work.

**Reference**

Castillo, E. (1988) *Extreme value theory in engineering.* Academic Press. 519.5 (2 copies)
Coles, S. (2001) *An introduction to statistical modeling of extreme values.* Springer. 519.24
Kotz, S. (2000) *Extreme value distributions : theory and applications.* Imperial College Press. 519.24