rmaxima

test page

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# library(rmaxima)
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integrate(x^3, x);
L: sqrt(1 - 1/(R^2));
assume(R>=0)
integrate(x, x, 0, L);
```

$$\frac{x^4}{4}$$

$$\sqrt{1-\frac{1}{R^2}}$$

$$[R \geq 0]$$

$$\frac{R^2-1}{2\,R^2}$$

```
inv_gamma(x, alpha, beta) := beta^alpha / gamma(alpha) * (1/x)^(alpha + 1) * %e^(-beta / x);
assume(s>0)$
assume(nu>0)$
inv_scaled_chisq(x, nu, s) := inv_gamma(x, nu/2, nu/2 * s^2);
norm(x, mu, sigma) := 1 / (sigma * sqrt(2 * %pi)) * %e^(-1/2 * ((x - mu)/sigma)^2);
t(x, nu) := gamma((nu + 1)/2) / (sqrt(nu * %pi) * gamma(nu / 2)) * (1 + x^2/nu)^-((nu + 1)/2);
```

$$\mathit{inv\_gamma}\left(x,\alpha,\beta\right):=\frac{\beta^{\alpha}}{\Gamma\left(\alpha\right)}\,\left(\frac{1}{x}\right)^{\alpha+1}\,e^{\frac{-\beta}{x}}$$

$$\mathit{inv\_scaled\_chisq}\left(x,\nu,s\right):=\mathit{inv\_gamma}\left(x,\frac{\nu}{2},\frac{\nu}{2}\,s^2\right)$$

$$\mathit{norm}\left(x,\mu,\sigma\right):=\frac{1}{\sigma\,\sqrt{2\,\pi}}\,e^{\frac{-1}{2}\,\left(\frac{x-\mu}{\sigma}\right)^2}$$

$$t\left(x,\nu\right):=\frac{\Gamma\left(\frac{\nu+1}{2}\right)}{\sqrt{\nu\,\pi}\,\Gamma\left(\frac{\nu}{2}\right)}\,\left(1+\frac{x^2}{\nu}\right)^{-\frac{\nu+1}{2}}$$

The predictive distribution of the mean of the missing data is

$$\bar{y}^{\text{miss}} \mid \mu, \sigma^2, \bar{y}^{\text{obs}} \sim N\left(\mu, \frac{\sigma^2}{(N-n)}\right)$$

Averaging over μ:

```
assume(sigma > 0, n > 0, N > 0)$
ratsubstflag: true$
integrate(norm(ymiss, mu, sigma/sqrt(N - n)) * norm(mu, yobs, sigma/sqrt(n)), mu, minf, inf);
```

$$\frac{\sqrt{N-n}\,\sqrt{n}\,e^{\frac{\left(n^2-N\,n\right)\,yobs^2+\left(2\,N\,n-2\,n^2\right)\,ymiss\,yobs+\left(n^2-N\,n\right)\,ymiss^2}{2\,N\,\sigma^2}}}{\sqrt{2}\,\sqrt{\pi}\,\sqrt{N}\,\sigma}$$

and averaging over σ^2:

```
% * inv_scaled_chisq(sigma^2, n-1, s^2);
ratsubst(sqrt(t), sigma, %);
integrate(%, t, 0, inf);
```

$$\frac{\sqrt{N-n}\,\left(n-1\right)^{\frac{n-1}{2}}\,\sqrt{n}\,2^{-\frac{n-1}{2}-\frac{1}{2}}\,s^{2\,(n-1)}\,\sigma^{-2\,\left(\frac{n-1}{2}+1\right)-1}\,e^{\frac{\left(n^2-N\,n\right)\,yobs^2+\left(2\,N\,n-2\,n^2\right)\,ymiss\,yobs+\left(n^2-N\,n\right)\,ymiss^2}{2\,N\,\sigma^2}-\frac{(n-1)\,s^4}{2\,\sigma^2}}}{\sqrt{\pi}\,\sqrt{N}\,\Gamma\left(\frac{n-1}{2}\right)}$$

$$\frac{\sqrt{N-n}\,\left(n-1\right)^{\frac{n-1}{2}}\,\sqrt{n}\,2^{-\frac{n-1}{2}-\frac{1}{2}}\,s^{2\,n-2}\,t^{-\frac{n}{2}-1}\,e^{\frac{\left(n^2-N\,n\right)\,yobs^2+\left(2\,N\,n-2\,n^2\right)\,ymiss\,yobs+\left(n^2-N\,n\right)\,ymiss^2}{2\,N\,t}-\frac{(n-1)\,s^4}{2\,t}}}{\sqrt{\pi}\,\sqrt{N}\,\Gamma\left(\frac{n-1}{2}\right)}$$

$$\frac{\sqrt{N-n}\,\left(n-1\right)^{\frac{n-1}{2}}\,\sqrt{n}\,2^{-\frac{n-1}{2}-\frac{1}{2}}\,s^{2\,n-2}\,\int_0^{\infty}t^{-\frac{n}{2}-1}\,e^{\frac{\left(n^2-N\,n\right)\,yobs^2+\left(2\,N\,n-2\,n^2\right)\,ymiss\,yobs+\left(n^2-N\,n\right)\,ymiss^2}{2\,N\,t}-\frac{(n-1)\,s^4}{2\,t}}\,dt}{\sqrt{\pi}\,\sqrt{N}\,\Gamma\left(\frac{n-1}{2}\right)}$$