MAS 3105 April 5, 2012
Quiz 6 and Key Prof. S. Hudson

1) Let S be the subspace of R^3 spanned by $\mathbf{x} = (1,0,1)^T$ and $\mathbf{y} = (0,1,1)^T$. Find an orthonormal basis of $S^\perp$.

2) In $C[0,\pi]$ with inner product $\int_0^\pi fg\,dx$, compute $\langle 2, 1+3\cos(x)\rangle$.

3) Answer True or False

For all nonzero vectors $\mathbf{x}, \mathbf{y} \in R^2$, $\mathbf{x^T y} = ||x||\ ||y||$.
If $A \in R^{m\times n}$ has rank n, then the normal equations for $Ax = b$ have a unique solution.
If A is symmetric, then $R(A) = N(A)^\perp$.
If $S = \text{span}\ \{\mathbf{e}_1, \mathbf{e}_2\} \subset R^3$ then $\text{proj}_S(\mathbf{e}_3) = \mathbf{0}$.
If S is a subspace of R^9 with dim $(S^\perp) \le 3$, then dim $(S) \le 6$.

Bonus: Suppose that A is a 4×4 diagonal matrix with entries $a_{ii} = i$. Find the trace of A (this is related to MATLAB problem, Ch 4, # 3).

Remarks and Answers: The average was about 82, very good. The scale for Q6 is

A's 90-100
B's 80-89
C's 70-79
D's 60-69

As usual, your approximate semester grade is in the upper right. This does not yet include your MHW grades or any extra credit. The class average for this stat is about 75.

1) The single vector $\frac{1}{\sqrt{3}}[1,1,-1]^T$ is a basis. This is a standard Ch. 5.2 problem. Set $S = R(A)$ where A is 3×2. So, $S^\perp = N(A^T)$ which is an easy Ch.1 problem because A^T is already RREF. You should get something like $[1,1,-1]^T$ and then normalize it.

2) 2π

3) FTTTF

Bonus) The trace is the sum of the diagonal entries, 1+2+3+4=10.