COMPSCI.373 TUTORIAL 4 SOLUTIONS

REVISION

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1 Vector Projection

Exercise 1.a.

$$\frac{A \bullet B}{|B|}$$

Exercise 1.b.

$$\frac{A \bullet B}{|B|}$$

$$A \bullet B = \begin{pmatrix} 1 \\ 2 \\ 3 \end{pmatrix} \bullet \begin{pmatrix} 1 \\ 3 \\ 4 \end{pmatrix} = 19$$

$$|B| = \sqrt{1 + 9 + 16} = \sqrt{26}$$

$$solution = \frac{19}{\sqrt{26}}$$

Exercise 1.c.

$$\frac{E \bullet F}{F \bullet F} F$$

$$E \bullet F = \begin{pmatrix} 0 \\ 1 \\ 3 \end{pmatrix} \bullet \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix} = 14$$

$$F \bullet F = \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix} \bullet \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix} = 29$$

$$\frac{E \bullet F}{F \bullet F} F = \frac{14}{29} \begin{pmatrix} 3 \\ 2 \\ 4 \end{pmatrix}$$

2 Area and Volume

Exercise 2.a.

$$\begin{pmatrix}1\\8\\1\end{pmatrix} \times \begin{pmatrix}1\\2\\1\end{pmatrix} = \begin{pmatrix}6\\0\\-6\end{pmatrix}$$
$$mag = \sqrt{2 \times 36} = 6\sqrt{2}$$

Exercise 2.b.

$$c \times d = \begin{pmatrix}2\\1\\3\end{pmatrix} \times \begin{pmatrix}1\\2\\3\end{pmatrix} = \begin{pmatrix}-2\\-5\\3\end{pmatrix}$$
$$|c \times d| = \sqrt{38}$$
$$solution = \frac{1}{2}\sqrt{38}$$

Exercise 2.c.

$$\begin{pmatrix}1\\2\\3\end{pmatrix} \times \begin{pmatrix}5\\1\\1\end{pmatrix} = \begin{pmatrix}-1\\14\\-9\end{pmatrix} \bullet \begin{pmatrix}2\\2\\1\end{pmatrix} = 17$$

3 Affine Transform

Exercise 3.a.

$$\begin{pmatrix}0 & -1 & 0\\1 & 0 & 0\\0 & 0 & 1\end{pmatrix} \begin{pmatrix}1 & 0 & -2\\0 & 1 & 2\\0 & 0 & 1\end{pmatrix} = \begin{pmatrix}0 & -1 & -2\\1 & 0 & -2\\0 & 0 & 1\end{pmatrix}$$

4 Find the Plane

Exercise 4.a. x - 2y + z = 0 goes through the origin and is one of the planes being intersected, therefore this is the solution!