

A RELATION BETWEEN *TUDUNG SAJI* WEAVING PATTERNS
AND GROUP THEORY

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AND GROUP THEORY

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To my dearest,

Papa (Zamri bin Abdul Rahman)

Mama (Sakinah bt Harun)

My Late Mama (Siti Maimunah bt Abdul Halim)

Nenek (Zainab bt Ismail)

My Late Atuk (Abdul Rahman bin Jusoh)

Lovely supervisor (Prof Dr Nor Haniza Sarmin)

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Examiners

Families

Friends

Supporters

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You Know Who

ALLAH SWT KNOWS BETTER

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ABSTRACT

Tudung saji is a traditional utensil used by the Malays to cover their food to be served. *Tudung saji* is woven with strands of dried leaves using a specific technique called triaxial weave, where the strands are plaited in three directions. Previously, a tool known as triaxial template had been created to represent the patterns of *tudung saji* weaving in a planar pattern. Based on this template, many beautiful and symmetrical patterns were successfully generated, creating some of the original patterns of *tudung saji*. These patterns are categorized according to the number of colours of the strands, from the basic 2-strand up to 6-strand template. The purpose of study is to find several finite groups to represent the triaxial weaving patterns on two dimensional templates, focussing only on the 2 and 3-strand templates. It is found that the symmetric group of two letters, S_2 and the cyclic group of order six, C_6 are isomorphic to the triaxial template of Flock of Pigeons and Sailboats patterns, respectively. These isomorphisms are determined by mapping the elements of the Flock of Pigeons and Sailboats onto the elements of the two groups. Using a software iMac Grapher, several graphs are generated based on the elements of the triaxial template patterns. Next, graph theory is used to analyze the properties of these graphs. The graphs are sorted by the numbers of strands, namely the graphs of block two, graphs of block three up to the graphs of block six. All such graphs are found to feature the characteristics of three types of graphs, namely a complete graph with three vertices, K_3 , a simple graph with six vertices, and an acyclic graph. Lastly, this research reports on modifications to the template by adding extra colours to the framework strands and the insertion strands. This is done by using new colour ordering in addition to the same colour ordering for the 2-strand template. As a result, a new characteristic on the modified template has been found, namely the existence of different triaxial patterns in one template.

ABSTRAK

Tudung saji adalah sejenis alat tradisi yang digunakan oleh masyarakat Melayu untuk menutup makanan hidangan mereka. Tudung saji dianyam dengan helaian daun kering menggunakan satu teknik anyaman tiga paksi, dengan untaianya dijalin dalam tiga arah. Sebelum ini, suatu alat yang dipanggil templat tiga paksi telah dihasilkan untuk membentuk corak anyaman tudung saji berpola satah. Berdasarkan templat tiga paksi ini, terdapat banyak corak cantik dan mempunyai simetri berjaya dihasilkan termasuk corak asal tudung saji. Corak-corak ini dikategorikan mengikut jumlah warna yang dimasukkan ke dalam setiap untaian, iaitu templat 2-untaian sehingga templat 6-untaian. Kajian ini bertujuan mencari beberapa kumpulan terhingga untuk mewakili corak anyaman tiga paksi dalam templat dua dimensi, dengan tumpuan kepada templat 2-untaian dan 3-untaian. Hasil kajian mendapati bahawa kumpulan simetri dua huruf, S_2 dan kumpulan kitaran peringkat enam, C_6 adalah isomorfik kepada templat tiga paksi yang bercorak Pati Sekawan dan Kapal Layar. Isomorfisma ini telah ditentukan melalui pemetaan di antara unsur Pati Sekawan dan Kapal Layar kepada unsur-unsur dua kumpulan tersebut. Dengan menggunakan perisian *iMac Grapher*, beberapa graf telah dihasilkan berdasarkan unsur templat tiga paksi ini. Seterusnya, teori graf telah digunakan untuk menghuraikan ciri-ciri yang terdapat pada graf yang terhasil daripada unsur corak templat tiga paksi. Graf-graf ini disusun mengikut jumlah untaian, yang dinamakan sebagai graf blok dua, graf blok tiga sehinggalah graf blok enam. Kajian menunjukkan semua graf ini mempunyai ciri tiga jenis graf, iaitu graf lengkap tiga bucu, K_3 , graf ringkas enam bucu, dan graf *acyclic*. Akhir sekali, kajian ini melaporkan beberapa pengubahsuaian yang dilakukan terhadap templat dengan memasukkan warna tambahan untuk menggambarkan untaian rangka dan juga untaian sisipan. Kaedah ini dilaksanakan dengan menggunakan susunan warna baru dan juga susunan warna yang sama dengan templat 2-untaian. Hasilnya, satu ciri baru telah dijumpai pada templat yang diubahsuai iaitu kewujudan corak-corak yang berbeza pada satu templat yang sama.