have suggested that vernalization can take place in the developing grain[15–17], none have suggested that the vernalization requirement for the following generation can be satisfied at a stage earlier than fertilization. Vernalization after grain formation can be discounted, for after the time of heading of autumn-sown lines of this variety (mid-November at Lincoln) protracted cold periods are not experienced, and the day-length is in excess of 13·5 h. In addition, this explanation would not allow for the differences found between the different spring-sown seed sources. If the effect is one of photoperiodic induction alone, the nature of the mechanism and the manner by which the stimulus is transmitted through the seed stage are not known. The modifications induced are not, however, permanent changes, and the effect can be reversed by exposing the seed line to the alternative set of environmental conditions.

The profound influence of the parental environment on the performance of the progeny has important implications. It makes necessary the use of strictly comparable seed in investigations of vernalization or photoperiodic response and for the accurate comparison of varieties in field trials.

A practical application of this effect with suitable varieties would be the control of the date of heading in commercial crops. Earlier ripening of spring wheat would be an advantage in the south of New Zealand, and field trials to investigate this effect and associated differences in performance of wheat varieties are being undertaken.

J. M. McEwan

Crop Research Division,
Department of Scientific and Industrial Research,
Christchurch,
New Zealand.

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GENERAL

Algorithm to assist in finding the Complete Sub-graphs of a Given Graph

Let the operation M, applied to a graph G, have the effect of removing from G all lines which are not members of at least one K_3 (a complete graph or sub-graph having three points, that is, a triangle). The new graph MG consists entirely of triangles, and it will be unchanged by a second application of the operator M. $M^2G = MG$.

This is not true of the operation D, to remove from G all lines which are not members of at least two K_3's, as Fig. 1 shows. However, D^nG converges with increasing n either to an empty graph or to a graph $D^\infty G$ of which every line is a member of at least two K_3's. This is of interest in comparison with the convergency of Boolean relation matrices[1]. Fig. 2 shows the two simplest symmetrical examples of a $D^\infty G$. Form 2(a) is a K_4. In the graphs investigated so far (not including crystal structure), form 2(b) has never occurred and every line has been a member of at least one K_4.

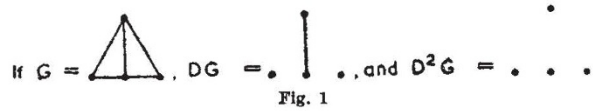

Fig. 1

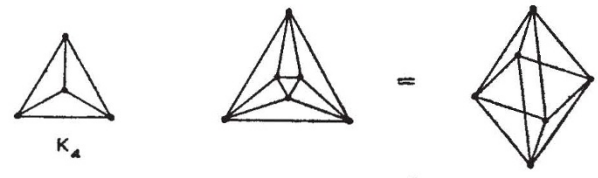

Fig. 2

Similarly, if TG is the graph left by removing all lines which are not members of at least three K_3's, all the lines in $T^\infty G$ were members of K_5's.

The time taken by a computer to find the K_4's and K_5's in a large graph is not long when the D^∞ or T^∞ algorithms are used. Applied to a graph of 1,000 points and 1,791 lines, D^4 was equal to D^3 and T^4, T^3 and T^2D were equal. After separation of the residue into its component sub-graphs, the original graph was seen to contain one K_6, twenty K_5's, and large numbers, not yet counted, of K_4's and K_3's. From an examination of the results, it seems unlikely that in this example there are any lines, like the twelve lines of Fig. 2(b), which belong to no K_4. Strictly, however, the algorithm should be supplemented by a test to distinguish the complete sub-graphs.

The graph-theoretical problems leading to our use of the foregoing algorithm arose out of an attempt to generate groups of words by purely mechanical operation on a large number of related documents. Words within groups were required to have strong associations with each other, and the groups were needed for research on the mechanical classification of documents. The presence or absence of each of 1,000 selected words or word-stems in each of 12,000 documents was recorded, as 1,000 binary vectors each having 12,000 bits. In comparing the vectors of every pair of words, an arbitrary test was made to decide whether the pair of words was "associated" or not. It was convenient to regard the results of the 500,000 tests as a graph on 1,000 points, each representing a word, in which a line joining two points represented an "association" between the words.

Thus, we were faced with the task of arranging the points of a large graph into groups, such that there were many lines within groups and few lines between groups. It was evident that groups of this kind would contain numerous complete sub-graphs; the algorithm provides one of several possible ways to find, first the complete sub-graphs, and then the groups.

The partitioning of graphs is becoming increasingly important in language studies, sociology, economics, network theory, logistics, automated computer design and many other situations where multiple association or correctedness is involved.

A. R. Meetham

Autonomics Division,
National Physical Laboratory,
Teddington, Middlesex.

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Some Observations on the Great Fire of London, 1666

1966 marks the tercentenary of the Great Fire of London. In reading descriptions of this fire, I was impressed by the facts that only four people died directly as a result of the fire and that only 436 acres were burnt in 87 h. The London fire is dwarfed when compared, for example, with the Chicago 'Mrs. O'Leary's Cow' fire of 1871 when 2,124 acres and 17,450 buildings were burnt between October 8 and 10, 250 people were killed and about