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The Black Box Experiment

A search for the electronic components inside a sealed black box is performed.

I. INTRODUCTION

Much of scientific research is concerned with searches of one kind or another. These may be as simple as trying to find a screwdriver in the lab or as involved as a search for the origin of the universe. There is a set of principles that serve as a guide to planning and executing searches. These principles are[1]:

1. Know as much as possible about the object of the search. It is particularly important to know those characteristics that can be used to distinguish the object of the search from the surroundings.

2. Prove, if possible, that the object exists in the area to be searched.

3. Use the most efficient method of detection.

4. Be sure you could identify the object if it were encountered. Is the sensitivity of your apparatus sufficient to detect the object of the search?

5. Be sure you wouldn't see the object when it was not there. Sometimes if you try hard enough, you can observe what you want to see, and not what is actually there.

6. Search systematically instead of haphazardly. This is the most important principle. Always be on guard against a breakdown in your systematic search procedure and path.

7. In many-dimensional searches it is usually necessary to devise a one-dimensional path. A two dimensional region cannot be covered by a one-dimensional path of finite length. Thus the path must have a finite width.

8. Identify the starting point of the search and record the path actually followed. If this is not done, the search is likely to lose any planned direction and becomes more and more random.

9. Use a convergent search procedure.

10. Search in the most probable place first. The ideal path would pass through the regions of highest probability first and then into regions of successively lower and lower probability.

11. Distribute the available time, facilities, and effort in reasonable proportions to the different regions of the search.

12. Take into account the finite probability of missing the object on passing by it.

13. Consider any effect that the search procedure may have on the search object. You need to be aware of how your apparatus may influence the results and interpretation of your measurement.

II. EXPERIMENTAL METHODS

The sealed black box is connected to the outside world by green, red, and black wires. The three wires are connected to n electronic components inside the box. The value of n is limited to $n \leq 3$ and the components are limited to resistors, inductors and capacitors. You are expected to identify the interior components as to type and value, and determine how they are connected to each other and to the external wires. A possible composition of the contents of the box is shown in Fig. 1.

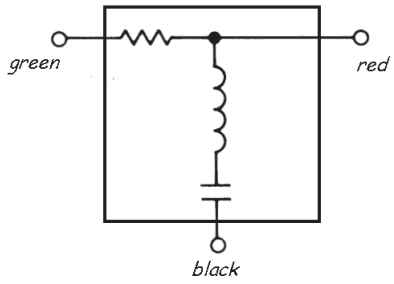

FIG. 1: One of the many possible configurations for the interior of the black box.

Be sure to carefully and fully document your search in your lab notebook. Record why you are attempting a particular measurement, how you did the measurement, the results of the measurement, and what you can conclude from that measurement about the contents of the box. You can use any instrument in the lab and have two lab periods to complete the experiment.

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[1] E. Bright Wilson, Jr., *An Introduction to Scientific Research*, Dover (1990).