Peters Problem 2012-3

In association with the Irish Mathematics Teachers Association and Engineers Ireland

A dog food manufacturer wishes to minimize the cost of packaging his canned product for distribution from his factory.

The dog food is contained in cylindrical cans of diameter 75mm and height 110 mm. The weight of each can is 435 grams and health and safety guidelines indicate that each pack cannot be heavier than 12kg.

(The weight of the packaging can be ignored)

The cans can be packed in single or multiple layers, standing upright on their circular end. Each layer of cans must be put on a corrugated cardboard tray surrounded with a rim to reach at least 35mm along the side of the cans measured from the base. The company packing machine can only handle cans packed in **rectangular** format.

The pack is then covered in a plastic sheet with an overlap of 5% of the length of one side <u>of the plastic sheet</u> at the join.

The cardboard comes in a width of 30cm and costs €9.50 per 100 metres. The supplier of the card can vary its width in units of 5cm only, at an additional cost of 75 cent. per 5cm per 100 metres.

The plastic comes in a roll of width 50cm and costs €42 per 1000 metres. The width of the plastic can be changed to order at a cost of 1% per cm. (i.e. A width of 53cm increases the cost by 3% and a width of 45cm reduces the cost by 5%)

Calculate the number of cans that should be packed together so that the cost of packaging is at a minimum, indicating whether the cans should be in single or multiple layers.

Notes

A detailed account of the approach taken to finding the solution, including incorrect and unsuccessful attempts, should be included with your solution in electronic form.

The answer should be presented in what you consider to be the most suitable format.

All assumptions that have been made should be included as an addendum.

List other factors not included in the problem which may influence the company's final decision on the format of packaging.

All clarifications and further details can be sought by directing your query to this email address: domguinan@eircom.net