

Pearson Edexcel

International Advanced Level

Applied ICT

International Advanced Level Unit 3: The Knowledge Worker

21 – 25 May 2018

Time: 2 hours 30 minutes

Paper Reference

WIT03/01

You must have:

Cover sheet, treasury tag, CRD_exam.xlsx, CLEANROOM_exam.txt

Instructions

- Complete your candidate details on the cover sheet provided.
- All printouts must contain your name, candidate number, centre number and activity number.
- At the end of the examination:
 - all printouts should be placed in the correct order
 - use a treasury tag to attach your printouts (**as shown**) to page 2 of the cover sheet.

Information

- The total mark for this paper is **90**.
- There are **four** activities in this examination totalling **88** marks. **Two** further marks are allocated to Standard Ways of Working.
- The marks for **each** question, within an activity, are shown in brackets
 - use this as a guide as to how much time to spend on each question.
- Questions labelled with an **asterisk** (*) are ones where the quality of your written communication will be assessed
 - you should take particular care on these questions with your spelling, punctuation and grammar, as well as the clarity of expression.

Advice

- Read through the scenario carefully.
- Work through the activities in order.
- Attempt **ALL** activities.
- Label your printouts clearly as instructed.
- Printing must be undertaken within the examination time.

Turn over ►

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Scenario

Ahmed Zubair grew up on the island of Zanzibar. His father worked hard, although his life as a fisherman was tough. He encouraged his three children, Nasser, Yasmin and Ahmed, away from the family tradition of fishing.

Nasser became a resident doctor at the island's largest hospital. Yasmin travelled to Canada and became a nurse in Montreal. Ahmed decided to specialise in medical engineering so he went to a UK university to develop these skills.

Ahmed kept in close contact with his brother and sister, meeting up with them during holiday periods. The three of them would often discuss problems they had encountered in hospitals. One common theme was the lack of medical cleanrooms.

Cleanrooms are designed to control the environment, preventing contamination from dust and airborne microbes.

Ahmed, on completing his degree, decided to look for employment in the cleanroom design industry. He found a job, as an assistant designer, at CleanRoom Tech, a small innovative company, which specialises in designing and creating cleanrooms. Despite being small, CleanRoom Tech had a wide range of international customers. Martin Smallwood, the company's chief project manager, recognised Ahmed's natural talent for design. Whenever possible he encouraged Ahmed to accompany him on site visits so that he could gain a clear understanding of customers' requirements.

Ahmed gained valuable experience at CleanRoom Tech, working for the company for five years. He soon realised that he wanted to develop his own company, so that he would have the freedom to experiment with new designs and products.

Unfortunately, his father died while he was in the UK. On returning home he was surprised to find that his father had left a considerable amount of money to his three children. They talked about using the money to set up a cleanroom design company. They all agreed and Zubair Cleanroom Design (ZCRD) was created. Nasser became the Director of Operations, Yasmin the Marketing and Sales manager, and Ahmed the Engineering and Project manager.

Ahmed realised, through his experience at CleanRoom Tech, that creating bespoke standalone cleanrooms was extremely expensive. He came up with the idea of creating a modular design which could be incorporated into existing rooms. These could be quickly set up, dismantled and moved elsewhere at a fraction of the cost of permanent structures.

ZCRD introduced a range of modular cleanrooms. There were seven designs, with different dimensions and volumes. Four of these are the standard range, the others are the plus range. All designs were suitable for hospitals, so initially ZCRD targeted these for its sales.

The modular cleanrooms became an instant success with orders coming in from all parts of the world.

The cleanrooms can be finished, at different costs, in white laminate, primer painted, or antibacterial UPVC, depending on their use.

Each cleanroom is fitted with air filters which are required to ensure that the air is frequently changed according to international standards.

Depending on the use of the cleanroom, the volume of air filtered must be between 10 and 500 times the room volume each hour. These are broken down into six categories, from category 1 (500 times), to category 6 (10 times).

ZCRD initially used five different air filters, made by FILT Supplies. The filters can remove between 110 and 550 litres of air per second. They have a lifespan between 30000 and 50000 hours. They cost between \$1010 and \$5050 US dollars.

In order to keep costs to a minimum Ahmed considered an additional source for air filters, produced by CAF Manufacturing. These filters remove between 240 and 680 litres of air per second. They have a lifespan between 20000 and 36000 hours which is shorter than the FILT filters. Their prices were significantly cheaper, between \$929 and \$1129 US dollars.

CAF filters were also available within two days, once an order had been placed, whereas there was a two-week delivery time for the FILT filters. This time difference was significant where a customer demanded a quick set up of a new cleanroom.

Monitoring their projects Yasmin found that the orders for Clean 2 plus, Clean 3 plus and Clean 4 plus were small so the company discontinued these at the end of 2017.

ZCRD's reputation for producing cost-effective quality cleanrooms quickly grew. It soon began to receive enquires from universities, food and drink manufacturers, medical device manufacturers and computer chip manufacturers across the globe.

Due to ZCRD's expansion you have been employed to look at the use of FILT filters and CAF filters. There is already a model which has been partly created to assist in decision making.

The model consists of these worksheets:

Worksheet	Description
Categories	Lists the international categories for cleanrooms relating to the number of air changes per hour
Cleanroomtype	Contains the data on cleanrooms produced by ZCRD
FILTfilters	Contains performance data on FILT filters
CAFFilters	Contains performance data on CAF filters
Clean3FILT	Used to compare FILT2 and FILT3 filters in cleanroom Clean3
Clean3CAF	Used to compare CAF2 and CAF3 filters in cleanroom Clean3
FilterComparisoncat3	Used to select filters for category 3 cleanrooms

Some worksheets in the model are password protected. Be aware if you change the contents of any protected worksheet the model may not work. Should you wish to experiment with the model, the password is *edexcel*.

Instructions to candidates

All printouts **MUST** have a header and a footer. The header must contain the activity number. The footer must contain your name, candidate number and centre number.

Minimum font size of 10 should be used throughout.

For some of your spreadsheet printouts you may need to adjust column widths.

All spreadsheet printouts should show gridlines, row and column headers.

Some worksheets in the model are password protected. Be aware if you change the contents of any protected worksheet the model may not work. Should you wish to experiment with the model, the password is *edexcel*.

Your task

You have been employed by ZCRD to complete the model and to make recommendations to the company on the types of air filter to be used.

Activity 1 Understanding the situation – (suggested time 20 minutes)

Read the scenario carefully.

On **one** sheet of A4:

- (a) Using a numbered list, identify **ten** points from the scenario relevant to the task. (10)
- (b) Create a **table** comparing the CAF and FILT air filters. (4)

Save and **print** your answer.

(Total for Activity 1 = 14 marks)

Activity 2 Completing the model – (suggested time 45 minutes)

You should ensure that each printout is on **one** sheet of A4 only.

The model is stored as **CRD_exam.xlsx**

Open the spreadsheet model and familiarise yourself with it.

(a) Cleanroomtype

Ahmed has produced a text file containing the ZCRD types of modular cleanrooms, with their dimensions.

You will find this data in the text file **CLEANROOM_exam.txt**

- (i) • Import the cleanroom data into cells A8:D14 of the 'Cleanroomtype' worksheet.
 - **Print off** columns A–D and rows 7–14 of the 'Cleanroomtype' worksheet showing **data**.
- (ii) • In cell E8 enter a formula to calculate the volume of cleanroom Clean 2 in litres.

Note: $\text{Volume} = \text{length} \times \text{width} \times \text{height}$
 $\text{Number of litres} = \text{cubic metres} \times 1000$

- Replicate this formula to cell E14.
- In cell F8 enter a formula which calculates the total volume of air removed in cleanroom Clean 2 if it is to meet category 1 standards.

Note: *The 'Categories' worksheet shows the air changes per hour required for international cleanroom categories 1 to 6.*
- Replicate this formula to cell K14 to show the total volume of the air removed per hour for each cleanroom for categories 1 to 6.
- **Print off** columns E, F, H and K and rows 6 to 14 showing **formulae**.

(8)

(b) **FILTFilters**

Cells A6 to E11 show the specification of each FILT air filter.

- (i) • Enter a formula in cell D14 to calculate the volume of air removed per hour for a FILT1 filter.
- Enter formulae in cells D15 to D21 to calculate the volumes of air removed per hour.
- Enter a formula in cell E14 to calculate the whole number of FILT1 filters required to meet category 1 requirements for a Clean 2 cleanroom.
- Replicate the formula in cell E14 to E21.
- Enter a formula in cell F14 to calculate the cost of FILT1 filters needed to meet category 1 requirements for a Clean 2 cleanroom.
- Enter formulae in cells F15 to F21 to calculate the cost of filters to meet category 1 requirements.
- **Print off** columns A, B, D, E and F and rows 13 to 21 showing **formulae**
- (ii) • In cells K14 to K21 enter formulae to calculate the volume of air removed per hour to meet category 6 requirements.
- In cells L14 to L21 enter formulae to calculate the whole number of filters needed to meet category 6 requirements.
- Enter formulae in cells M14 to M21 to calculate the cost of filters to meet category 6 requirements.
- **Print off** columns H, K, L , and M and rows 13 to 21 showing **formulae**.

(9)

(c) **CLEAN3FILT**

The Clean 3 cleanroom can use either the FILT2 or FILT3 type filter.

(i)

- Enter a formula in cell B8 which shows the cost of using FILT2 filters to meet the category 1 standard for a Clean 3 cleanroom.
- Enter formulae in cells B9 to B13 which show the cost of using FILT2 filters to meet the category 2, 3, 4, 5 and 6 standards respectively, for a Clean 3 cleanroom.
- Enter a formula in cell E8 which shows the cost of using FILT3 filters to meet the category 1 standard for a Clean 3 cleanroom.
- Enter formulae in cells E9 to E13 which show the cost of using FILT3 filters to meet the category 2, 3, 4, 5 and 6 standards respectively, for a Clean 3 cleanroom.
- **Print off** columns A to E and rows 6 to 13 showing **formulae**.

(ii)

- Plot a chart or graph to show the variation in the cost of filters to meet categories 1 to 6 when using FILT2 and FILT3 filters for a Clean3 cleanroom.
- On your chart or graph indicate where it is cheaper to use the FILT3 filter.
- **Print** a copy of your chart or graph, which should include appropriate labelling of axes and a suitable heading.

(7)

(d) **CLEAN3CAF**

- Plot a chart or graph to show the variation in the cost of filters to meet categories 1 to 6 when using CAF290 and CAF390 filters for a Clean 3 cleanroom.
- On your chart or graph indicate where it is cheaper to use the CAF290 filter.
- **Print** a copy of your chart or graph, which should include appropriate labelling of axes and a suitable heading.

(4)

(e) **FilterComparisoncat3**

The worksheet shows the options available to meet a category 3 cleanroom.

- In cells D7 to D22 create a Yes/No drop-down option for each cell to show which filter model is selected for use.
- Use your Yes/No options to show which filter you would use for each type of cleanroom on the basis of cost alone.
- In cell D22 show that both the Yes and No options are available. Take a screenprint and paste this into a suitable document, ensuring that cells A6 to D22 are shown.
- **Save** the document.
- **Print out** this document on **one** sheet of A4 paper.

(4)

(f) **Printouts**

- Collect your printouts together, ensure you have printed them correctly and that they are in the order you have been asked to print them.

(3)

Ensure you have **saved** your solution; you will need it later.

(Total for Activity 2 = 35 marks)

Activity 3 Lifespans – (Suggested time 40 minutes)

In 2018 both FILT Supplies and CAF Manufacturing introduced new filter models with different performance characteristics. Both companies now only offer four types of filter rather than five, all of which ZCRD is considering using for cleanrooms. FILT reduced its prices, whereas CAF increased its. Therefore further investigation is required to find which models of filter to use. The 'Filters2018' worksheet holds the new data.

Open the '2018Category' worksheet and familiarise yourself with it.

(a) 2018Category

The lifespan of the filters can be 2.5% above or below the manufacturers' values.

- In cell H8 enter a formula to calculate the minimum lifespan of the FILT11 filter.
- Replicate this formula to cell H15.
- In cell I8 enter a formula to calculate the maximum lifespan of the FILT11 filter.
- Replicate this formula to cell I15.

A filter is replaced if **either** the minimum lifespan or maximum lifespan is less than the number of hours of use which is shown in column M.

- Enter a formula in cell J8 to show if the FILT11 filter requires replacing. If the value in cell H8 **or** in cell I8 is less than, or equal to, the value shown in M8, 'Yes' should be displayed; otherwise 'No' should be displayed.
- Replicate this formula to cell J15.
- If 'Yes' is displayed in cell J8 then the filters need to be replaced at least once. Enter a formula in cell K8 to calculate the cost of the FILT11 filters for the hours shown in cell M8. This is calculated by comparing the value in cell M8 with the value shown in cell H8; otherwise the value from cell E8 should be displayed.
- Replicate this formula to cell K15.
- In cell N8 enter a formula which compares the cost of FILT11 and CAF192 filters for use in a Clean 2 cleanroom. The formula should display 'Yes' for the cheaper option otherwise 'No' should be displayed.
- Replicate this formula to cell N11.
- In cell N12 enter a formula which displays 'No' if N8 displays 'Yes'. Otherwise N12 must display 'Yes'.
- Replicate this formula to cell N15.
- Apply conditional formatting to cells N8 to N15. The background colour must change to a different colour if the word 'Yes' is displayed. You must ensure the text is still visible.
- **Print off** columns C, H, I, J, K and N, rows 7 to 15 showing **formulae**.

ZCRD has budgeted the amounts shown in cells H23 to H28 for installations which meet categories 1 to 6 across all their cleanrooms. It would like to know the number of years of use that can be expected within each budget.

Column A displays the categories from 1 to 6. Column L displays the number of years of use for the cleanroom. Column M displays the corresponding number of hours of use (with no allowance for leap years). Cell O16 shows the total cost of the filters selected.

- Initially in column A set the category for each filter to 1.
- Using the budget shown in cell H23, find the maximum numbers of years for which each filter can be used. This number **must** be the same for each filter. In cell I23 type in the maximum number of years.
- Repeat this for categories 2 to 6 and complete cells I24 to I28.
- **Print off** columns G, H and I and rows 22 to 28 showing **data**.

(23)

(b) **Printouts**

- Collect your printouts together, ensure you have printed them correctly and that they are in the order you have been asked to print them.

(1)

Ensure you have **saved** your solution; you will need it in Activity 4

(Total for Activity 3 = 24 marks)

***Activity 4 – Report** (suggested time 35 minutes)

Write a report for ZCRD making recommendations about the types of air filters to be used:

- up to 2018
- after the 2018 model changes made by the manufacturers.

The report should include:

- suitable titles and section headers
- an introduction explaining what the report is about
- your recommendations, with justifications of:
 - the types of air filters used up to 2018 for a Clean 3 cleanroom to meet the international categories from 1 to 6
 - the types of air filters used after the 2018 model changes made by the manufacturers.
 - the expected number of years of use within the budgets set by ZCRD
- an evaluation of the model and suggestions on how to adapt and improve it.

Proofread your report.

Marks will be awarded for the quality of your written communication.

Save and print your work.

(15)

(Total for Activity 4 = 15 marks)

Standard Ways of Working

All printouts must contain the activity number, your name, candidate number and centre number.

Pages must be securely fastened to the cover sheet and in the correct order.

Minimum font size of 10 should be used for all word processed documents.

(Standard ways of working = 2 marks)

TOTAL FOR PAPER = 90 MARKS

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