Edexcel GCE

Applied Information and Communication Technology
Unit 3: The Knowledge Worker

14 – 18 May 2012 **Time: 2 hours 30 minutes**	Paper Reference **6953/01**

You must have:
Cover sheet, short treasury tag, PriauxData_exam.pdf,
Patrick_exam.xls

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
- There are **five** activities in this examination totalling **88** marks. **2** further marks are allocated to Standard Ways of Working.
- The marks for **each** question in each 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 ▶

PEARSON

Scenario

Patrick Racing

Dan Patrick was a talented motor racing driver. He drove in Formula 1 (F1) for three seasons from 1972–74. Although he won several Grand Prix races, he was never crowned world champion. His driving career was brought to a sudden end at Monza, when a tiny misjudgement on the exit of the Parabolica resulted in a serious accident. There followed a long and arduous stay in hospital where he had to learn to walk again. Although he can now walk, he is unable to bend his left ankle and his right knee has to be exercised regularly to prevent it from seizing up.

Dan Patrick loves motor racing and, having been robbed of the ability to drive, he put his skill, knowledge, determination and a significant amount of money into the development of 'Patrick Racing'. Initially 'Patrick Racing' ran small teams in Formula BMW and Formula Renault. This year it is running a team in the brand new F1 Junior formula, which is considered to be the training ground for F1 itself.

The F1 Junior formula is for petrol-powered cars of 3000cc or less. The competition consists of 12 races on European Grand Prix circuits. Each race is about 395 km long.

Regulations state that at least one but fewer than five pit stops should be made in a race, when tyres must be changed and fuel may be added. They also state that no part of a car, except the tyres, should be less than 2 cm from the ground. In addition, a car and driver should weigh no less than 640 kg at the end of the race. Any breach of regulations could result in disqualification.

If the weight of a car with a driver in it is less than the required minimum, ballast can be added to the car to ensure the minimum weight is attained. Ballast can only be added before a race starts.

Each team runs two cars. 'Patrick Racing's' drivers are Pete Lawson and Cathryn Williams, better known as CJ.

Pete Lawson, at 35, is a driver who is slowly coming to terms with the fact that he will never make it to the very top. He is 175 cm tall and weighs 61 kg.

CJ on the other hand is an up and coming star. A lot of very knowledgeable people have predicted that she will be the first female world champion. Her height is 151 cm and she weighs 53 kg.

The 'Patrick Racing' cars weigh 560 kg each and their fuel tank capacity is 250 litres.

The tyres are supplied to all teams by a single company. For each race the teams have a choice of tyres made from four different compounds. These are known by the teams as Tyre A, Tyre B, Tyre C and Tyre D. Tyre A is the softest compound and Tyre D is the hardest. Tyres B and C are in between. The softer a tyre's compound, the better the grip and therefore the faster the car goes when the tyre is new. However, softer compounds wear more quickly and when a tyre wears the grip is reduced and the car cannot be driven as quickly.

Each team nominates the tyre compound they will use and although they can put on new tyres of the nominated compound during a pit stop, they cannot put on a different type of tyre.

The next race is at the Priaux circuit in Belgium and teams are busy preparing for it. A challenge is that the management of the circuit has recently had the track resurfaced so any existing data relevant to pit stops and tyre performance is no longer valid. Dan has dispatched his chief mechanic, Tom Cole-Shaw, to Priaux along with a test driver and a team of mechanics to run timing tests. The data they produce will be entered into a model which, when complete, will inform the team's decisions.

You are the team's IT specialist and Dan has asked you to complete the model and use it to make some recommendations.

Description of the model

Worksheet	Description
Summary	In this worksheet you can choose tyre compound for the race and how much fuel to add at the start of the race and at each pit stop. Other parameters can also be set on this worksheet.
Lap Times	This worksheet calculates various parameters for each lap depending on values entered in the Summary worksheet. It will give a lap-by-lap status for the car during the virtual race.
Stats	This worksheet will contain statistics which you will enter.
Tyre Details	This worksheet calculates a lap-by-lap time prediction for each tyre. These times assume ideal circumstances.

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

Your Task

You have been asked by the management of 'Patrick Racing' to advise them on key decisions for the forthcoming Priaux race.

The Data

The chief mechanic, Tom Cole-Shaw, has taken a team to run timing tests at the Priaux circuit to provide you with the data you need to complete your spreadsheet model.

The tests consisted of a number of 10-lap stints on each tyre compound. New tyres were put on at the start of every stint and only enough fuel was loaded to complete a stint. Seven 10-lap stints were completed on each of the four tyre compounds.

The data was used to calculate two constants for each type of tyre. The first constant is a base lap time. Effectively, this is the best lap time for each type of tyre. The other value is a tyre degradation constant which is used to calculate the effect tyre wear will have on lap times for a particular compound.

The data is in the file **PriauxData_exam.pdf**

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 **must** be used throughout.

All spreadsheet printouts **must** show gridlines and row and column headers.

For some of your spreadsheet printouts you may need to adjust column widths. To do this you will need to unprotect the worksheets. The password is *edexcel*.

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

You should look at **all** of the information available to you, including the model, and make sure that you understand the situation.

On **one** sheet of A4, using **bullet pointed answers**:

(a) List **15** key facts relevant to the use of the model.

(15)

(b) List **5** recommendations you have to make.

(5)

Save and print your work.

(Total for Activity 1 = 20 marks)

Activity 2 – Sources of information (suggested time 10 minutes)

The model uses two constants for each type of tyre, calculated from the test data. These are a base lap time and a tyre degradation constant.

On **one** sheet of A4:

❑ Describe circumstances and conditions during the testing that you think may affect the accuracy of the model's predictions for the race.

Save and print your work.

(Total for Activity 2 = 8 marks)

Activity 3 – Computer modelling (suggested time 45 minutes)

The model is stored as **Patrick_exam.xls**

Open the spreadsheet model and familiarise yourself with it.

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

(a) **Stats**

- ❑ Enter the data from **PriauxData_exam.pdf** into the correct cells on the 'Stats' worksheet. You should use the weight of Driver 1 initially.

- ❑ Set the amount of ballast you wish put on the car at the start of the race (you can change this later if you want to).

- ❑ Print off columns A–H and rows 8–21 of the 'Stats' worksheet showing **data**.

(5)

(b) **Lap Times**

- ❑ Enter a formula into cell E9 of the 'Lap Times' worksheet to calculate the weight of the fuel in cell D9.
  Hint: weight of a litre of fuel is in the 'Stats' worksheet.

- ❑ Replicate the formula down to E84.

- ❑ Enter a formula into cell F9 to calculate the combined weight of fuel, car, ballast and driver at the start of the race.

- ❑ Enter a formula into cell F10 that will:

  - check cell B10 of the 'Lap Times' worksheet

    - if B10 contains the word "Finished" then F10 should display the same weight as the previous lap (F9)

    - if B10 does not contain the word "Finished" then F10 should calculate the combined weight of fuel, car, ballast and driver at the end of one complete lap.

- ❑ Replicate the formula down to F84 to calculate the combined weight at the end of each lap.

- ❑ Enter a formula into cell I10 that will:

  - check cell B10 of the 'Lap Times' worksheet

    - if B10 contains the word "Finished" then I10 should display '0'

    - if B10 does not contain the word "Finished" then I10 should contain the elapsed time at the end of the previous lap (I9) plus the time taken for the current lap (H10).
      Hint: the cell above holds the elapsed time at the end of the previous lap.

- ❑ Replicate this formula down to cell I84.

- ❑ Print off columns E, F and I and rows 9–15 of the 'Lap Times' worksheet showing **formulae**.

(14)

(c) **Summary**

A stint is the period of a race between two pit stops, the start of the race and the first pit stop, or the last pit stop and the end of the race. The stint laps column will contain the number of laps in each stint.

❏ Enter a formula into cell F12 to calculate the number of laps between the start of the race and the first pit stop.
Hint: you will replicate this formula to calculate the number of laps in the other stints.

❏ Replicate the formula down to cell F15.

❏ In cell B21 enter a formula to show the final weight of the car.
Hint: look in the 'Car Weight' column of the 'Lap Times' worksheet.

❏ In cell G21 enter a formula to calculate the final race time.

❏ In cell H21 enter a formula to show the final race time in hh:mm:ss format.
Hint: Look in the 'Elapsed Time' column of the 'Lap Times' worksheet.

❏ Print off columns B–H and rows 10–21 of the 'Summary' worksheet showing **formulae**.

(6)

(d) **Using the model**

The model is used by:

• selecting a tyre type in cell C11 of the 'Summary' worksheet

• selecting pit stops by setting cells B12 to B15 to either 'Yes' or 'No' and setting the lap you stop on in cells D12 to D15; e.g. If you want your first pit stop to occur on lap 23 then set B12 to 'Yes' and D12 to '23'.

• entering the amount of fuel to put in at the start of the race and during pit stops in cells G11 to G15.

Note: If you wish to adjust the amount of ballast at the start of the race, you should adjust cell B15 on the 'Stats' worksheet.

❏ Use the model to investigate tyre and pit stop strategies for Driver 1 that meet all the regulations.

❏ With your best solution showing, print off the 'Summary' worksheet showing **data**.

(7)

(e) **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.

(7)

(Total for Activity 3 = 39 marks)

*Activity 4 – Report (suggested time 35 minutes)

Write a report for Dan Patrick, recommending a pit stop strategy for the Priaux race. Remember the strategy should include tyre choice, fuel loads, number of pit stops, when the pit stops should occur and the amount of ballast to load.

The report should include:

❑ a suitable title

❑ an introduction explaining what the report is about

❑ the pit stop strategy for Driver 1 set out in a table

❑ a justification of why you made these recommendations

❑ issues which may affect the validity of the strategy

❑ a graph of the predicted weight of the car and driver (car weight) throughout the race

❑ a concluding statement.

Proof read your report.

Marks will be awarded for the Quality of Written Communication (QWC).

Save and print your work.

(Total for Activity 4 = 15 marks)

Activity 5 – Reusing the model (suggested time 10 minutes)

Discuss the implications of using the model for:

❑ the second driver

❑ different circuits.

Save and print your work.

(Total for Activity 5 = 6 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.

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

(Standard Ways of Working = 2 marks)

TOTAL FOR PAPER = 90 MARKS