

P425/2

APPLIED MATHEMATICS

PAPER 2

JUNE 2015

3 HOURS

SECTION A: (40 MARKS)

Answer all the questions in this section.

1. A continuous r.v X has the following p.d.f $f(x)$:

$$f(x) = \begin{cases} \beta x^2 & , \quad 0 \leq x \leq 2 \\ \beta(6-x) & , \quad 2 \leq x \leq 6 \\ 0 & , \quad \textit{otherwise} \end{cases}$$

(i) Sketch the p.d.f of X . **(02 marks)**

(ii) Find the value of β **(03 marks)**

2. Show that the equation $\tan x - 4x = 0$ yields Newton Raphson's

formula $x_{n+1} = x_n - \frac{\tan x_n - 4x_n}{\tan^2 x_n - 3}$. Hence taking $x_0 = 1.4$, find

the second approximation correct to three decimal places. **(05 marks)**

3. Joan can either use a bus or a taxi to go to work. The chance that she uses a bus is $\frac{1}{4}$. If she uses a bus, the chance that she will be late is $\frac{2}{3}$, otherwise it is $\frac{3}{5}$. Find the chance that she will:

(i) be late on a particular day.

(ii) use a taxi given that she is punctual. (05 marks)

4. The grades of 6 students in **test 1** and **test 2** were as follows:

<i>TEST 1</i>	<i>A</i>	<i>E</i>	<i>C</i>	<i>O</i>	<i>B</i>	<i>D</i>
<i>TEST 2</i>	<i>O</i>	<i>B</i>	<i>D</i>	<i>A</i>	<i>E</i>	<i>C</i>

Calculate the rank correlation coefficient for the scores in the two tests. Comment on your result. (05 marks)

5. A delivery service company charges **sh 2800**, **sh 3600** and **sh 5200** for parcels of weights **2kg**, **3kg** and **5kg** respectively. Estimate the:

(i) charge for a parcel of weight **4.5kg**.

(ii) weight of the parcel which is charged **shs 2400**. (05 marks)

SECTION B: (60 MARKS)

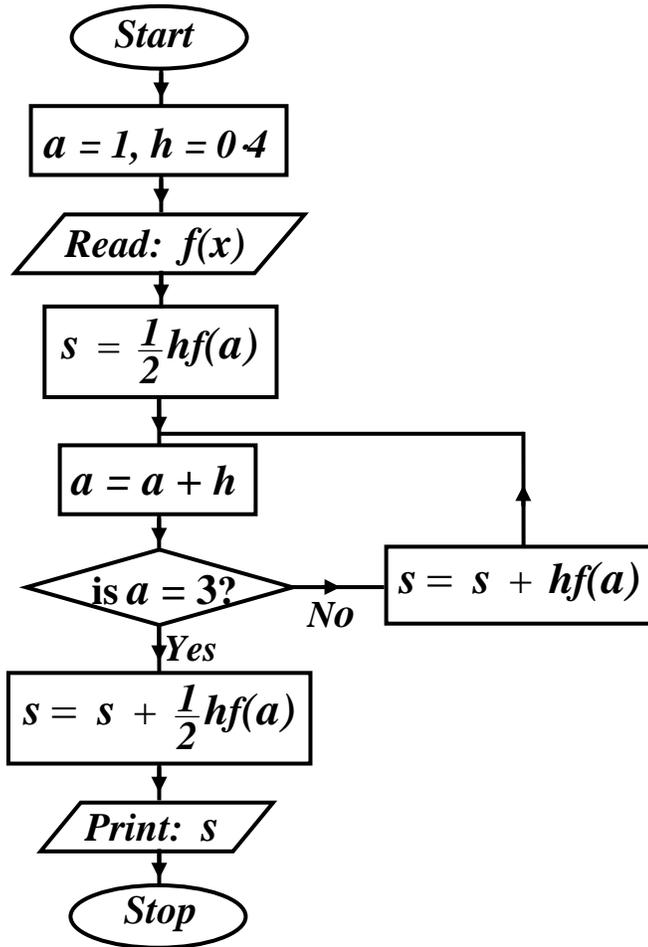
Answer all the questions in this section.

6. The table below shows the prices and price indices for three items in the years **2013** and **2014** respectively.

<i>Items</i>	<i>Price in 2013</i>	<i>Price Indices in 2014 Using 2013 as base</i>
<i>A</i>	<i>32,00</i>	<i>125</i>
<i>B</i>	<i>4,000</i>	<i>105</i>
<i>C</i>	<i>4,500</i>	<i>120</i>

- (a) Calculate the price of each item in **2014**. *(03 marks)*
- (b) Taking **B** as the base item, calculate the price indices for **2013**.
(03 marks)
- (c) Using weights **3**, **5** and **2** for item **A**, **B** and **C** respectively, calculate the:
- (i) weighted average price index of the items in **2014**. *(03 marks)*
- (ii) weighted aggregate price index of the items in **2014**.
(03 marks)
7. (i) Use a graphical method to find the initial approximate root of the equation $2\log_{10} x = 1$.
- (ii) Use Newton Raphson's method to find the root of the equation in (i) above correct to **3** decimal places. *(12 marks)*

8. (i) Study the flowchart below:



Using $f(x) = \sqrt{1+x}$, perform a dry run for the flow chart. Give your output correct to three decimal places. (05 marks)

(ii) Find the exact value of $\int_1^3 \sqrt{1+x} dx$ (03 marks)

(iii) State the purpose of the flow chart in (i) above. (01 mark)

(iv) Find the error in your output in (i) above and suggest how it can be reduced. (03 marks)

9. (a) A discrete r.v \mathbf{X} has the following p.d.f.

$$P(X = x) = \begin{cases} 2P^x & , \quad x = 1, 2, 3, \dots \\ 0 & , \quad \textit{otherwise} \end{cases}$$

Find:

(i) the value of \mathbf{P} .

(ii) $\mathbf{P}(X \geq 3)$ (05 marks)

(b) Three fair coins are tossed together. Find the:

(i) probability distribution for the number of heads obtained

(ii) mean and variance of the distribution in (i) above (07 marks)

10. (a) Box \mathbf{P} contains 3 white and 4 blue balls while box \mathbf{Q} contains 5 white and 3 blue balls. A ball is drawn at random from \mathbf{P} and put into \mathbf{Q} , and then a ball is taken from \mathbf{Q} and put into \mathbf{P} . Find the probability that the ball drawn now from box \mathbf{P} is white.

(05 marks)

(b) Bag \mathbf{X} contains 4 red and 3 blue pens, while bag \mathbf{Y} contains 3 red and 2 blue pens. A bag is selected at random and two pens are drawn from it without replacement. Find the probability that:

(i) they are of different colours

(ii) bag \mathbf{Y} is selected given that the pens drawn are of the same colour. (07 marks)