

Wednesday 03 May 2017

9.00 am to 12.00 pm

Paper M1

ORGANIZATIONAL BEHAVIOUR AND MARKETING

*Answer **four** questions, **two** from Section **A** and **two** from Section **B**.*

*Answers to Sections **A** and **B** must appear in two separate booklets.*

*All **eight** questions carry 25 marks each.*

STATIONERY REQUIREMENTS

2 x 20 Page Booklet

Rough Work Pads

You may not start to read the
questions printed on the subsequent
pages of this question paper until
instructed that you may do so by the
Invigilator

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SECTION A

1 (a) Describe the components of the Big Five personality test, and critically evaluate the usefulness of the Big Five approach to personality testing.

[12.5 marks]

(b) Examine how the Big Five personality traits influence work behaviour.

[12.5 marks]

2 (a) Briefly describe the Job Characteristics Model and Self-Determination Theory. **[6.25 marks]**

(b) Compare and contrast both approaches: what do they have in common, and where do they differ? **[6.25 marks]**

(c) Outline an example of a workplace intervention that integrates both approaches. **[12.5 marks]**

3 You have been elected President of your country after a contentious, divisive, and hard-fought election. One of your first responsibilities is to form a leadership team.

(a) Explore five challenges you will face in selecting and leading this team. **[10 marks]**

(b) How might you go about resolving these challenges so as to give your team the best chance of succeeding? **[15 marks]**

4 (a) Explain five forces that stimulate organizational change. **[6.25 marks]**

(b) Explain five sources of resistance to organizational change. **[6.25 marks]**

(c) Describe and analyse the usefulness of one theory of organizational change. **[12.5 marks]**

(TURN OVER)

SECTION B

5 'Beats by Dre' is a very popular brand of headphones, yet has been rated poorly in independent tests of sound quality and overall value. Imagine that you decided to start a headphone company, because you believed you could create a headphone brand that would be preferred by consumers over 'Beats by Dre'.

(a) Describe your headphone brand (this could involve functional and/or branding elements), and why you think your brand would be preferred by consumers over 'Beats by Dre'. **[12.5 marks]**

(b) Describe the market segment(s) you would target for your headphones, and how you would test the feasibility of your idea by conducting market research. **[12.5 marks]**

6 Imagine that you are a brand manager for a company that makes laptop computers. Imagine that you wanted to apply the evolutionary psychology concept of 'Deep Rationality' to market your computer brand more effectively. Choose any two of the six 'evolutionary modular social domains' and describe how you would use these two modular domains to market your computer brand. **[25 marks]**

7 Imagine that you are the social media manager for the Alzheimer's Association, a non-profit organization whose mission statement is to "eliminate Alzheimer's disease through the advancement of research; to provide and enhance care and support for all affected; and to reduce the risk of dementia through the promotion of brain health." (Alzheimer's disease is a progressive mental deterioration that can occur in middle or old age, due to generalized degeneration of the brain. It is the commonest cause of premature senility.)

(a) Create a content marketing campaign that would help achieve the goals outlined in the organization's mission statement. **[12.5 marks]**

(b) What are the key social media platforms you would use for the Alzheimer's Association? Briefly explain your reasons for choosing these platforms. **[6.25 marks]**

(c) How would you measure the effectiveness of your social media efforts? Briefly explain why you have chosen this measure (or measures). **[6.25 marks]**

8 Four important concepts in behavioural decision theory and brand psychology are 'framing', 'motivated reasoning', 'decision simplicity', and 'anchoring and adjustment'.

Imagine that you are a brand manager for a company that makes smartphones. Discuss how you would apply three of these concepts to influence consumers to buy your company's smartphone, and/or to use the phone in ways that would increase revenues for the brand. **[25 marks]**

END OF PAPER

MGT1
MANAGEMENT STUDIES TRIPOS

Tuesday 02 May 2017 1.30 pm to 4.30 pm

Paper M2

QUANTITATIVE METHODS AND OPERATIONS MANAGEMENT

Answer **four** questions, **two** from Section **A** and **two** from Section **B**.

Answers to Sections **A** and **B** must appear in two separate booklets.

All **eight** questions carry 25 marks each.

N.B. THE FINAL TWO SHEETS OF THIS PAPER ARE SPECIAL DATA SHEETS

STATIONERY REQUIREMENTS

2 x 20 Page Booklets

Rough Work Pads

SPECIAL REQUIREMENTS

Approved calculators allowed

<p>You may not start to read the questions printed on the subsequent pages of this question paper until instructed that you may do so by the Invigilator</p>
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SECTION A

1 (a) Smart Utility is considering whether or not to install a new production line for making domestic appliances. Three suppliers have made bids to build the production line for Smart Utility. The first supplier offers a basic production line which automatically produces parts of acceptable, but not outstanding, quality. The weekly production output from this production line varies and might be 1,000 units with probability 0.1, 2,000 units with probability 0.7, or 3,000 units with probability 0.2. The unit profit for parts produced by this production line is £4. The second supplier offers a premium production line which makes the highest quality parts. The weekly production output from this production line might be 700 units with probability 0.4, or 1,000 units with probability 0.6. The unit profit for parts produced from this production line is £10. The third supplier offers a flexible production line which managers can set to produce either 1,300 high-quality units a week at a profit of £6 per unit or 1,600 medium-quality units a week with a profit of £5 per unit.

If the chosen production line produces 2,000 or more units a week, Smart Utility can sell all production as a single bulk order. If this is the case, then there is a 60% chance of selling the order for 50% more profit, and a 40% chance of selling the order for 50% less profit.

(i) Construct a decision tree for Smart Utility. **[7 marks]**

(ii) What is the optimal decision strategy for Smart Utility, and what is the expected profit (EMV) for Smart Utility? Support your answers with calculations. **[7 marks]**

(iii) For the optimal contingency plan/decision that you identify in (ii), specify the corresponding risk profile. **[3 marks]**

(b) Consider two uncertain numbers X and Y .

(i) Define the correlation coefficient of X and Y in words and mathematically. **[2 marks]**

(ii) Compare the correlation coefficient and covariance between X and Y . **[3 marks]**

(c) Consider the decision tree analysis approach.

(i) Is it possible to take risk into consideration when you evaluate a project? If yes, briefly describe how you do it. **[3 marks]**

(TURN OVER)

2 (a) Snow Spring produces spring water and it has to deliver 100,000 bottles of spring water per month for the next four months. The production capacity per month is 200,000 bottles. The production cost per bottle is £5 during month 1, £9 during month 2, £10 during month 3, and £14 during month 4. The bottles produced in a month can be sold in the same month or later months. The inventory cost for unsold bottles is £3 per bottle per month. The total inventory capacity per month for Snow Spring is 250,000 bottles.

(i) Snow Spring wishes to make a four-month production plan. Formulate this problem as a linear program for minimising the total production and inventory cost. **[12 marks]**

(b) Consider confidence intervals for the population proportion.

(i) Define the margin of error and explain its meaning. **[2 marks]**

(ii) Why is it preferable to have a smaller margin of error? How can you decrease the margin of error? **[3 marks]**

(c) Consider two assets X and Y which have uncertain outcomes and assume their correlation coefficient is r .

(i) Construct a portfolio Z based on assets X and Y . Describe how the risk (e.g., variance) of portfolio Z changes with a change of the correlation coefficient r . **[4 marks]**

(ii) For asset X , discuss **two** measures of risk other than variance and standard deviation. **[4 marks]**

3 (a) In a television advertisement, mobile phones produced by a firm have an advertised life of 30,000 hours on average. A sample of 49 such phones had an average life of 29,500 hours, with a standard deviation of 2,000 hours.

(i) At a 10% significance level, what can you conclude about the advertisement? Use a formal hypothesis test to support your conclusion. **[6 marks]**

(ii) At what significance level would you change the conclusion obtained in (i)? **[2 marks]**

(b) Consider a resource allocation problem and suppose a corresponding linear program is formulated and solved by Solver, an Excel add-in.

(i) Describe how the optimal solution and optimal objective function value change when either an objective function coefficient or the right-hand side of a constraint changes. **[6 marks]**

(c) Suppose that you roll 100 dice many times. Each time, you calculate the mean of 100 dice, which is denoted by X .

(i) Argue why the mean of 100 dice is an uncertain number. **[2 marks]**

(ii) Describe the shape (or probability distribution) of the uncertain number X and its key statistics. **[2 marks]**

(iii) Describe how you can estimate the mean of a die by rolling a die multiple times. **[2 marks]**

(d) Consider two assets X and Y and for investment weight α , construct portfolio $v = \alpha X + (1 - \alpha) Y$. Assume the correlation coefficient between X and Y is r .

(i) In the same chart, draw several indicative scatter diagrams of the variance and rate of return of portfolios when $r = 1, 0.5, 0, -0.5$ and -1 . **[3 marks]**

(ii) Assume $\text{var}(X) = \text{var}(Y)$, $r < 1$ and $0 < \alpha < 1$. Use a scatter diagram of the variance and rate of return of portfolios to illustrate that $\text{var}(v) < \text{var}(X)$, i.e., the risk of portfolio v is smaller than the risk of asset X . **[2 marks]**

4 (a) The PrettyHome Estate has recently conducted a study of homes sold in the local area within the past 18 months. Data were recorded for the asking price and the number of weeks the home was on the market before it sold. A random sample of 17 houses, which were sold at the asking price with prices ranging between £50,000 and £150,000, has been used to develop the Excel regression results as shown in the table overleaf.

(TURN OVER)

Question 4 continues...

SUMMARY OUTPUT

<i>Regression Statistics</i>	
Multiple R	0.705948
R Square	0.498363
Adjusted R Square	0.464921
Standard Error	11.964179
Observations	17

ANOVA

	<i>df</i>	<i>SS</i>	<i>MS</i>	<i>F</i>	<i>Significance F</i>
Regression	1	2133.111647	2133.11164	14.902111	0.001541
Residual	15	2147.123648	143.14157		
Total	16	4280.235294			

	<i>Coefficients</i>	<i>Standard Error</i>	<i>t Stat</i>	<i>P-value</i>	<i>Lower 95%</i>	<i>Upper 95%</i>
Intercept	-16.225062	12.202527	-1.329648	0.203502	-42.234148	9.784024
Asking Price	0.000528	0.000137	3.860325	0.001541	0.000237	0.000820

(i) What is the estimated regression model? Explain what the variables and constants mean, if appropriate. **[2 marks]**

(ii) Provide and explain a 95% confidence interval for the slope of the regression equation. **[2 marks]**

(iii) Use the regression equation to predict the number of weeks a house for which the asking price is £100,000 will be on the market before it is sold. Give a rough 95% prediction interval for the predicted number of weeks on the market before the house is sold. Interpret your result intuitively. **[3 marks]**

(iv) Can you use the above regression equation to predict the number of weeks on the market before the house is sold at a price of about £250,000? Explain your answer. **[2 marks]**

(v) For the independent variable 'Asking Price', explain the following columns in the regression Summary Output and their relationship: *Standard Error*, *t Stat*, *P-value*, *Lower 95%*, *Upper 95%*? **[3 marks]**

(vi) Make comments on this regression model to the management team at the PrettyHome Estate. **[3 marks]**

(b) Suppose you want to estimate the value of a project using Monte Carlo simulation.

(i) List the main steps of conducting Monte Carlo simulation and describe the purpose of each step. **[3 marks]**

(ii) Define the law of averages and illustrate it with a business example. **[3 marks]**

(c) Consider the decision tree analysis approach.

(i) Define the concept of the expected value of perfect information (EVPI) and briefly describe why it is important to find EVPI. **[4 marks]**

SECTION B

5 Each year The Boot Pub runs a special invite-only concert by Purple Floyd, a popular – but aging – rock band in a field adjacent to the pub. All patrons follow a standard sequence to verify their eligibility, collect and pay for tickets, collect their complementary drink, and clear a security check. Tickets are sold on an individual basis only, and based on previous experience around 300 patrons are expected to attend the event. Observations of the process reveal the following information.

The first step in the process is for all patrons to have their status on the invite list verified, upon presentation of suitable identification. Once verified, a wristband is then provided to the patron. One staff member performs this step, which takes on average 30 seconds.

The second step in the process is ticket collection, where patrons join a single queue. Three staff members work this step, and take on average 30 seconds per patron to enter the ticket request and print a ticket. The staff member must then also process payment via cash (task time 20 seconds), credit card (task time 40 seconds), or cheque (task time 170 seconds). Approximately 40% of transactions are in cash, 50% using a credit card, and the remainder via cheque.

The third step in the process is for patrons to collect their complementary bottle of cider, wine or soft-drink. The average patron takes around 10 seconds to choose their drink. The drinks station has been pre-prepared prior to gates opening with drinks available in sufficient quantity to serve all patrons. No staff members are required to perform this step.

(TURN OVER)

Question 5 continues...

Question 5 continued ...

Patrons must then walk for about two minutes through the field to the concert venue, whereupon they queue in the order of arrival for a bag security check (task time 20 seconds). Four staff members perform this step. Upon completion of the security check, the patron gains entry into the concert venue.

The event runs once a year, and causes considerable headache for the organisers. As the operations manager explains: "We do a good job of processing entry up until the last half hour before the start of the concert, whereupon demand for entry spikes significantly. At that point, our patrons grumble and complain about the wait to see Purple Floyd, and that puts enormous pressure on our staff! We wish we could do better."

(a) Assuming there are no patrons already in the system, how long (in seconds) will it take for one patron, paying for a ticket in cash, to enter the process and gain entry into the concert venue? **[2 marks]**

(b) Calculate the capacity for each step of the process. Which step is the bottleneck? **[6 marks]**

(c) How many patrons can gain entry in one hour? **[2 marks]**

(d) What is the overall resource utilisation rate? Assume demand exceeds capacity, and that the process admits orders at the rate of the bottleneck. **[3 marks]**

(e) What changes would you suggest to improve the operational performance of The Boot's ticketing processes described above? Calculate the potential effects of your suggestions on the process performance. **[12 marks]**

6 Zoom Pizza was founded by Ryan McCorry in response to his frustration with receiving soggy, room temperature pizza from his local London pizza shop, often delivered later than promised. He founded Zoom Pizza on the belief that everyone deserves wholesome, artisan pizza at a fair price, and fast. Ingredients are sourced from local city farms, the flour is non-GMO (non-genetically modified) and the artisan cured meats are crafted by hand. The menu of a dozen or so options changes seasonally.

Zoom Pizza owns and operates three pizza delivery trucks. The delivery trucks look standard, like a FedEx or Royal Mail truck, but the interior is highly customised. Inside there are 56 GPS-connected mini ovens - which can be turned on and off remotely - neatly stacked into two racks on wheels which lock into place when the truck is being driven.

Using advanced data algorithms, Zoom understands its customers' pizza ordering habits. It knows which pizzas customers are likely to order and at which time of the day, and starts to produce them in advance of those orders even being placed. Inside the Zoom factory, a team of mostly robots - with some human input - assembles 14-inch pizzas, each of which gets loaded, partially-baked, into its own mini oven. The delivery vans are then sent out to circle the neighbourhood. Delivery time is consistently around 20 minutes, following placement of the customer order.

Customers place their orders via the Zoom app, and the logistics software coordinates the deliveries. Four minutes before the truck is scheduled to arrive at a doorstep, the algorithm starts the oven (or ovens) to finish cooking the order. Each pizza is then ejected into a special pizza pod, which is not cardboard. Rather, it's a customised sugar cane fibre, which helps keep the pizza crispy, and is also totally biodegradable and compostable. The driver then parks, cuts the pizza with a special blade and delivers a fresh, hot and sizzling pizza to the customer.

Whether the truck has five pizzas or 56, it needs just one human worker – to drive the truck, slice the pizza and deliver it to your doorstep. As Ryan says “The driver doesn't have to think about when to turn the ovens on, or whether to turn the ovens off. They don't have to think about what route to take, or which customer to go to first. All of that is driven by our proprietary algorithm.”

Zoom Pizza employs far fewer workers than the average pizza chain. While the robots in the factory cost between £20,000 and £30,000 each, Ryan says the investment will quickly pay off once you compare it to the salary of a human being. Further, as the factory is run mostly by robots, when customers call - regardless of whether it's off-peak or a crazy peak time - Zoom's factory is able to accommodate that level of demand. Similarly, Zoom Pizza can also dynamically adjust how many delivery vans are on the road in order to match customer demand.

(a) Describe Zoom Pizza's competitive priorities. **[5 marks]**

(b) Discuss the different operations choices made by Zoom Pizza.
[12 marks]

(c) Do you think that Zoom Pizza is likely to be a success? Discuss with reference to the operational challenges and opportunities you see for their business model. **[8 marks]**

(TURN OVER)

7 Jane Coyle, the new hotel manager at The Milton Hotel ('The Milton'), rubbed her temples in exasperation. She'd just been appointed to The Milton, supposedly one of Cambridge's few luxury 5-star hotels, and was charged with revitalising the premium service experience consistent with the hotel's history and brandname. Customers came to The Milton with expectations of personalised service (e.g. remembering their name), wow moments that would delight them, and immediate and comprehensive response to their requests. Instead they often got unresponsive, distracted, and impolite service from the staff – if any staff were available at all. In fact, Jane observed that "When it comes to customer service at this place, it seems people are unhappy no matter what side of the counter they're on. Why can't we get it right?"

(a) Describe the dimensions Jane might use to assess the quality of service provided at The Milton. For each dimension, give an example of how it should apply to the customer experience at a luxury 5-star hotel.
[8 marks]

(b) How might Jane think about closing the gap between customer perceptions and expectations at The Milton? **[8 marks]**

Separately, the operations manager of The Milton is concerned about the number of errors occurring at the front desk. Over the last month, the front desk processed 2,200 guests. Analysis of guest preferences indicated the following potential sources of error at this stage: the reservation cannot be found on the system at check-in; the guest had been allocated the wrong room type; the allocated room is not ready for the guest; the guest is checking out and the room charges are incorrect; and specific information about the reservation (e.g. membership of the loyalty programme) has not been entered onto the system. 75 separate errors were identified during the period, based on 55 complaint forms received from guests.

(c) What is the defects per million opportunities (DPMO) for this process?
[3 marks]

(d) Describe and apply two tools the operations manager might use to identify the root cause of one of the customer service errors experienced at the hotel's front desk. **[6 marks]**

8 Dingley Primary School (DPS) employs 30 teachers and 10 teaching assistants, who teach about 400 students from pre-school to Year 6. As with many educational departments, DPS is seeing demand for places continuously rising, but funding increasingly scarce. Currently, however, the school was 'good enough' - it had a solid academic standing and was well regarded by the childrens' parents and the local community - but the head teacher, Jessica McQuillan, was convinced it could do better.

After a recent dinner party conversation with a Lean consultant, Jessica thought that perhaps Lean thinking might provide an avenue for addressing the school's problems and issues. She reflected on the multitude of difficulties experienced by the school community every day. Teachers, for example, spend many hours thinking up new creative ways of delivering materials, as well as preparing lesson plans that they don't end up using. Teaching assistants (TAs) regularly wander the halls trying to find empty classrooms to conduct student assessments and interventions, and when they do locate one, it is often locked. For the students, moving from one end of the School grounds to another between classes meant lessons often started late or were interrupted. The administrative offices were also in a constant state of clutter: full of office supplies, and old classroom furniture and materials held on to 'just-in-case' a teacher might use them again.

For Jessica and her management team, their working environment was similarly difficult and they often struggled to keep a grip on the overall operations of the school. Day-to-day communication between the heads of the teaching departments and their staff was poor. Jessica also worried about the effects of variation in teaching quality on student learning outcomes. As she explained "Our school culture has always been about the individual teachers. We need to move from *my* teaching plan to *our* teaching plan."

(a) Describe four sources of waste in the DPS educational system.
[8 marks]

(b) Discuss the initial steps you would recommend Jessica take in order to prepare DPS for the introduction of Lean thinking? **[5 marks]**

(c) What Lean tools and techniques would you recommend as being most suitable for addressing the problems faced by Jessica in this educational context? Discuss how they might be applied within the School.
[12 marks]

END OF PAPER

SPECIAL DATA SHEET 1

Formula sheet

Standard errors

$$STEM = \frac{\sigma}{\sqrt{n}} \approx \frac{s}{\sqrt{n}}, \quad STEP = \sqrt{\frac{p(1-p)}{n}} \approx \sqrt{\frac{q(1-q)}{n}},$$

$$STEDM = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2}} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}.$$

Covariance, Correlation and Regression

Consider data pairs $(X_1, Y_1), (X_2, Y_2), \dots, (X_n, Y_n)$.

Let m_X and m_Y denote the respective means of the X and Y data.

Let s_X and s_Y denote the respective standard deviations of the X and Y data.

Covariance between X and Y is given by

$$\text{cov}(X, Y) = \frac{\sum_{i=1}^n (X_i - m_X)(Y_i - m_Y)}{n} = \frac{\sum_{i=1}^n X_i Y_i}{n} - m_X m_Y$$

The correlation coefficient between X and Y is given by

$$\text{correl}(X, Y) = r = \frac{\text{cov}(X, Y)}{s_X s_Y}.$$

The line of best fit is given by

$$Y - m_Y = \frac{r s_Y}{s_X} (X - m_X).$$

Variance of a portfolio

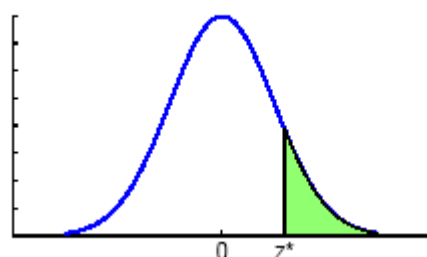
Consider three random variables x, y and z with means m_x, m_y , and m_z , respectively; variances $\text{Var}(x), \text{Var}(y)$, and $\text{Var}(z)$, respectively; and covariance between x and y , for example, given by the formula above. Given any numbers $\alpha_x, \alpha_y, \alpha_z$, let $v = \alpha_x x + \alpha_y y + \alpha_z z$. Then the variance of v is given by

$$\begin{aligned} \text{Var}(v) &= \alpha_x^2 \text{Var}(x) + \alpha_y^2 \text{Var}(y) + \alpha_z^2 \text{Var}(z) \\ &\quad + 2(\alpha_x \alpha_y \text{cov}(x, y) + \alpha_y \alpha_z \text{cov}(y, z) + \alpha_x \alpha_z \text{cov}(x, z)) \end{aligned}$$

SPECIAL DATA SHEET 2

Standard Normal Distribution Table

(Areas under the standard normal curve beyond z^* , i.e., shaded area)



z^*	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010

MGT1
MANAGEMENT STUDIES TRIPOS

Thursday 04 May 2017

1.30 pm to 4.30 pm

Paper M3

ECONOMICS WITH ACCOUNTING AND FINANCE

Answer **four** questions, **two** from Section **A**, **one** from Section **B(1)** and **one** from Section **B(2)**.

Answers to Sections **A**, **B(1)** and **B(2)** must appear in **three** separate booklets.

All **eight** questions carry 25 marks each.

STATIONERY REQUIREMENTS

3 x 20 Page Booklets

Rough Work Pads

SPECIAL REQUIREMENTS

Approved calculators allowed

<p>You may not start to read the questions printed on the subsequent pages of this question paper until instructed that you may do so by the Invigilator</p>
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SECTION A

- 1 (a) Define complements and substitutes in economics. **[5 marks]**

Imagine there is a reduction in the global supply of wheat due to a poor harvest in Russia. Explain the following, using appropriate diagrams:

- (b) The impact on the market for rice in China. **[10 marks]**

- (c) The impact on Chinese rice producers. **[10 marks]**

- 2 (a) Give an example of a normal form game with more than one Nash equilibrium. **[5 marks]**

- (b) Distinguish carefully between **three** models of oligopoly. **[10 marks]**

- (c) For each of the models in (b), discuss a specific market that, in your view, might be well described by it. **[10 marks]**

- 3 (a) Using transaction cost theory, explain why a firm exists. **[5 marks]**

- (b) Using **two** theories of the firm, explain why a firm might take over another firm. **[10 marks]**

- (c) For an industry of your choice, explain the degree of vertical integration you observe in it, using theories of the firm. **[10 marks]**

- 4 (a) State and explain the Keynesian expenditure equation for GDP. **[5 marks]**

- (b) Discuss the possible impacts of the outcome of the 2016 Brexit referendum on UK aggregate national income. **[10 marks]**

- (c) For **one** named firm of your choice, explain how having a good understanding of aggregate consumption and investment could help its profitability. **[10 marks]**

(TURN OVER)

SECTION B(1) Answer ***EITHER*** Question 5 ***OR*** Question 6

5 'Oldies Ltd.', an antiques dealer, was launched on 1 April, 2016. The owners invested £45,000 cash and £10,000 worth of office equipment into the business. The office equipment is to be used for 8 years and then to be sold for £2,000. Therefore, the opening balances of the business as at 01.04.2016 were:

Oldies Ltd.		
Trial Balance as at 01.04.2016		
	Dr	Cr
Fixed assets	10,000	
Cash	45,000	
Capital		55,000
	<hr/> 55,000	<hr/> 55,000

The following transactions took place during the financial year that ended on 31 March, 2017.

1. Antique furniture costing £30,000 was bought from suppliers; £5,000 was still owed to suppliers as at 31.03.2017.
2. Half of the furniture was sold for £50,000; £40,000 was still owed by customers as at 31.03.2017.
3. The business paid cash expenses: employee salaries, £10,000; advertising expenses, £3,000; rent and utilities, £7,000.
4. £5,000 was paid to insure valuable antique furniture for the period 01.01.2017-31.05.2017.
5. The business accounted for depreciation on office equipment on a straight-line basis.
6. The owners withdrew £2,000.

(a) Record in journal form how you would deal with transactions 1 – 6.

[7 marks]

(b) Write up the business' ledger for the year (including separate accounts for various expenses), and draw up the trial balance as at 31.03.2017. **[4 marks]**

(c) Produce a profit and loss account for the year ended 31.03.2017 and the closing balance sheet as at 31.03.2017. **[5 marks]**

(d) Using the indirect method, derive the cash generated from operations for the year ended 31.03.2017; and briefly outline the usefulness of the cash flow statement. **[4 marks]**

(e) In order to improve the business' liquidity position, the owners considered taking out a short-term loan of £10,000 (at 10% interest rate p.a.) during the year ended 31.03.2017. Discuss the impact that the loan would have had on the following three ratios: Net Profit Margin, Current Ratio, Debt-to-Equity. What other actions could the business have taken to enhance its liquidity?

[5 marks]

6 Extracts from the financial statements of a business entity which declared bankruptcy shortly after the publication of the results of Year 3 are given below:

Balance Sheet extracts:

	<i>amounts in £ million</i>		
	Year 1	Year 2	Year 3
Property, plant, equipment	130	224	326
Current assets	785	708	1,198
Inventories	431	472	735
Trade receivables	297	199	315
Cash & cash equivalents	12	10	82
Total assets	1,651	1,783	2,763
Current liabilities	(432)	(679)	(880)
Trade payables	(289)	(504)	(600)
Total (short- & long-term) borrowings	(375)	(451)	(1,333)
Total equity	750	578	563

Income Statement extracts:

	<i>amounts in £ million</i>	
	Year 2	Year 3
Sales revenue	1,950	2,114
Cost of sales	(1,413)	(1,413)
Operating expenses	(452)	(471)
Interest expense	(63)	(81)
Net profit	14	98

(a) Using the information provided above, calculate appropriate profitability, efficiency, liquidity, and gearing ratios for Years 2 and 3. **[10 marks]**

(b) Do the ratios provide any warning of the business' eventual demise? Do you identify any peculiarities in the business' ratios and/or financial data?

[10 marks]

(c) Briefly (in no more than 60 words each) explain the following concepts:

(i) balance sheet identity

(ii) accrual accounting **[5 marks]**

(TURN OVER)

SECTION B(2) Answer ***EITHER*** Question 7 ***OR*** Question 8

7 (a) At the end of June 2001, the yield to maturity on U.S. government bonds maturing in 2006 was about 4.8 percent.

 (i) Value a bond with a 6 percent coupon maturing in June 2006. The bond's face value is \$10,000. Assume annual coupon payments and annual compounding.

 (ii) How does your answer change if the bond has semi-annual coupons and a semi-annual discount rate of 2.4 percent?

 (iii) For both cases, how would the bond's value change if interest rates fell to 3.5 percent per year? **[15 marks]**

 (b) A two-year bond pays a coupon rate of 10 percent and has a face value of \$1,000. If the bond is initially sold for \$960, what is its approximate yield to maturity? *Hint:* This may require some trial-and-error calculations.
[10 marks]

8 A widget manufacturer currently produces 200,000 units a year. It buys widget lids from an outside supplier at a price of \$2 a lid. The plant manager believes that it would be cheaper to make these lids rather than buy them. Direct production costs are estimated to be \$1.50 a lid. The necessary machinery would cost \$150,000. This investment could be written off for tax purposes using the eight-year tax depreciation schedule given below. The plant manager estimates that the operation would require additional working capital of \$30,000 but argues that this sum can be ignored since it is recoverable at the end of the 10 years. The company pays tax at a rate of 35 percent and the opportunity cost of capital is 15 percent.

Is the plant manager's belief correct? State clearly any additional assumptions that you need to make. **[25 marks]**

Tax Depreciation Schedule

1	2	3	4	5	6	7	8
14.29%	24.49%	17.49%	12.49%	8.93%	8.93%	8.93%	4.45%

END OF PAPER

Tuesday 01 May 2018

9.00 am to 12.00 pm

Paper M1

ORGANIZATIONAL BEHAVIOUR AND MARKETING

Answer **four** questions, **two** from Section **A** and **two** from Section **B**.

Answers to Sections **A** and **B** must appear in two separate booklets.

All **eight** questions carry 25 marks each.

STATIONERY REQUIREMENTS

2 x 20 Page Booklet

Rough Work Pads

You may not start to read the
questions printed on the subsequent
pages of this question paper until
instructed that you may do so by the
Invigilator

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SECTION A

1 Sue needs your help. Upon graduating from Cambridge, she received 5 job offers and selected the job paying the highest salary. She tells you: "After just 6 months, I have no time anymore for my friends, my job is always the same, I work long hours and I thought the high pay would feel much more rewarding than it does." Discuss Sue's situation with a special emphasis on theories regarding motivation learnt in the course. What advice can you give her for her future? **[25 marks]**

2 Why is organizational change difficult, and when can change succeed? **[25 marks]**

3 Judy is a development aid worker in South America. She is frustrated because she feels she could improve local people's lives much better if she had greater autonomy. Yet, she is given precise strategies, orders and instructions from the organization's head office in London. Evaluate the organization's current leadership strategy and use your knowledge of leadership theory to propose an alternative approach to leadership. **[25 marks]**

4 Does emotional intelligence matter for managers? Explain your answer. **[25 marks]**

(TURN OVER)

SECTION B

5 Imagine that you decide to start a business. This business can be in any industry of your choosing. Describe how you would use content marketing to gain new customers. **[25 marks]**

6 Imagine that you decide to start a business. This business can be in any industry of your choosing. Describe how you would use the principles of brand psychology and consumer decision-making to design and market your product. **[25 marks]**

Note 1: If you answer both questions 5 and 6, please choose different industries and products for each question.

Note 2: The number of brand psychology and decision-making principles you use is up to you. The quality of your answer matters more than the quantity of principles you choose.

7 Imagine that you are employed as a Brand Manager for University XYZ, and that the university wants to increase its academic reputation by trying to attract undergraduate students who might otherwise choose to attend Cambridge or Oxford. How might you use a) marketing research and b) segmentation, targeting, and positioning, to attract students to attend University XYZ?
[25 marks]

Note 1: University XYZ is a fictitious university. Specific characteristics of the university are not necessarily important for answering the question, though you may make and state any assumptions you like about the university.

Note 2: The quality of your answer will be judged as a whole; responses to “marketing research” and “segmentation targeting and positioning” will not be graded separately.

8 Imagine that you are employed as the Brand Manager for Tourism by the government of an exotic island. How would you use the principles of Deep Rationality, which are based on evolutionary psychology, to market the island as a travel destination to potential tourists? **[25 marks]**

Note: The number of Deep Rationality principles you use is up to you. The quality of your answer matters more than the quantity of principles you choose.

END OF PAPER

Wednesday 02 May 2018 9.00 am to 12.00 pm

Paper M2

QUANTITATIVE METHODS AND OPERATIONS MANAGEMENT

*Answer **four** questions, **two** from Section **A** and **two** from Section **B**.*

*Answers to Sections **A** and **B** must appear in two separate booklets.*

*All **eight** questions carry 25 marks each.*

N.B. THE FINAL TWO SHEETS OF THIS PAPER ARE SPECIAL DATA SHEETS

STATIONERY REQUIREMENTS
2 x 20 Page Booklets
Rough Work Pads

SPECIAL REQUIREMENTS
Approved calculators allowed

<p>You may not start to read the questions printed on the subsequent pages of this question paper until instructed that you may do so by the Invigilator</p>
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SECTION A

1 (a) Carlos is considering placing a bet on the upcoming football game between University A and University B in the National University League. The winner of this game will represent the nation in the International University League. Without any additional information, Carlos believes that University A has a chance of p of winning this game. If he places and wins a bet on the game, he will win £500. If he loses the bet, he will lose £550. Before placing his bet, he may decide to pay his friend Gloria, who happens to be a football writer for London Sports, £50 for Gloria's expert prediction on the game. Assume that Gloria predicts that University A will win similar games with probability p , which is the same as the value p used by Carlos. Carlos knows that when Gloria predicts that University A will win, there is a 70% chance that University A will indeed win the football game. Moreover, when Gloria predicts that University B will win, there is a 20% chance that University A will win the football game. Assume Carlos will make a decision to maximise his expected monetary value (EMV).

(i) Assume $p = 0.45$. Construct a decision tree for Carlos. **[6 marks]**

(ii) Assume $p = 0.45$. What is the optimal decision strategy for Carlos and what is the EMV for Carlos? Support your answers with calculations. **[6 marks]**

(iii) Assume all else fixed and p can take different values. With what value for p , would Carlos change his decisions? Support your answers with calculations. **[4 marks]**

(b) Consider two uncertain numbers X and Y .

(i) Define the correlation coefficient of X and Y in words and mathematically. **[2 marks]**

(ii) Is the correlation coefficient scale independent? Explain your answer. **[3 marks]**

(c) In Monte Carlo simulation, suppose the key performance indicator is the profit Y , which is uncertain and depends on several factors such as parameters, uncertain numbers and a decision variable X . For each value for X , one can obtain a shape (a probability distribution) for Y . Explain how you compare two different probability distributions for Y that are obtained using two different values for X . **[4 marks]**

(TURN OVER)

2 (a) A firm must meet (on time) the following demands: quarter 1, 3,000 units; quarter 2, 2,000 units; quarter 3, 4,000 units. Each quarter, up to 2,700 units can be produced with regular-time labour, at a cost of £40 per unit. In each quarter, an unlimited number of units can be produced with overtime labour, at a cost of £60 per unit. At the end of each quarter, 10% of unused inventory is unsuitable and cannot be used to meet any future demands. After each quarter's demand is satisfied and unsuitable inventory is accounted for, a cost of £15 per unit is charged for the remaining usable inventory. Assume that 1,000 usable units are available at the beginning of quarter 1. Note that you do not need to count the inventory cost for the available 1,000 usable units at the beginning of quarter 1.

(i) The firm wishes to make a three-quarter production plan. Formulate this problem as a linear program for minimising the total production and inventory cost. **[10 marks]**

(b) For the population proportion, explain confidence intervals and hypothesis testing and the relationship between them. Note that you do not need to explain the processes of how to construct confidence intervals and conduct hypothesis testing. **[4 marks]**

(c) Consider Monte Carlo simulation:

(i) One can conduct sensitivity analysis using two tools: the Data Table and the Tornado Diagram. Define the Data Table and the Tornado Diagram and explain their use. **[5 marks]**

(ii) Define the value driver tree and explain its use. **[2 marks]**

(d) Consider the profit of a project, which is uncertain and has values between -£10 million and £10 million. Draw a cumulative distribution graph for the project and explain how you find the probability such that the profit is between £0 million and £1 million. **[4 marks]**

3 (a) A study of non-fatal occupational injuries in the United States found that about 31% of all injuries in the service sector were back injuries. Some similar claims have been reported in other countries. A year ago, an online retailer in the UK implemented a new strategy, called Alpha, to help the delivery force of the retailer to be more productive and to reduce back injuries during deliveries. Using a sample of 400 delivery drivers who have been delivering products for the retailer in the last four years, the retailer collected the following data:

	Average delivery time	Standard deviation of delivery time	Proportion of back injuries
Year 1 (without Alpha)	8.10 hours	1.40 hours	1.8%
Year 2 (with Alpha)	7.80 hours	1.30 hours	1.0%

(i) At a 10% significance level, what can you conclude about the new strategy Alpha on the average delivery time? Use a formal hypothesis test to support your conclusion. **[6 marks]**

(ii) Assume that 1.8% in the above table represents the proportion of injuries for delivery drivers in the past for the retailer. At the 5% significance level, what can you conclude about the new strategy Alpha on the proportion of injuries? Use a formal hypothesis test to support your conclusion. **[4 marks]**

(iii) Explain two approaches with which you can reduce the width of confidence intervals for the population proportion. **[2 marks]**

(b) Consider a maximising linear program which is implemented in the Excel Solver. The Sensitivity Report is shown in the table overleaf.

Based on the Sensitivity Report, discuss sensitivity analysis with respect to the objective function coefficients and the right-hand sides of the three less-than-or-equal-to constraints. **[6 marks]**

(TURN OVER)

Variable Cells

Cell	Name	Final Value	Reduced Cost	Objective Coefficient	Allowable Increase	Allowable Decrease
\$F\$7	A	6.093023256	0	55	8.157894737	4.666666667
\$G\$7	B	16.74418605	0	60	7.777777778	7.75
\$H\$7	C	0	-11.39534884	35	11.39534884	1E+30
\$I\$7	D	0	-22.29651163	40	22.29651163	1E+30
\$J\$7	E	0	-42.12209302	20	42.12209302	1E+30

Constraints

Cell	Name	Final Value	Shadow Price	Constraint R.H. Side	Allowable Increase	Allowable Decrease
\$K\$10	Constraint 1	408	0.901162791	408	55.15789474	144
\$K\$11	Constraint 2	194.8837209	0	272	1E+30	77.11627907
\$K\$12	Constraint 3	440	2.209302326	440	127.5384615	52.4

(c) In decision tree analysis, different decision-making criteria may be used: maximising the expected monetary value (EMV) or maximising the minimum value.

(i) Compare the above two decision-making criteria. **[2 marks]**

(ii) Explain the difference between the above two decision-making criteria when you use a rolling-back technique for finding the value of the decision tree. **[2 marks]**

(d) Consider two assets X and Y . For investment weight α , construct portfolio $v = \alpha X + (1 - \alpha) Y$. Assume the correlation coefficient between X and Y is r .

(i) Assume $\text{var}(X) = \text{var}(Y)$, $r < 1$ and $0 < \alpha < 1$. Explain why it is possible that $\text{var}(v) < \text{var}(X)$, i.e., the risk of portfolio v is smaller than the risk of asset X . **[3 marks]**

4 (a) Baseball statistics have been intensively used for evaluating performance of baseball teams. The winning percentage is one of the most important key performance indicators for baseball teams. Among many others, key performance drivers are 'Runs', 'Hits', 'Home Runs', 'RBI' and 'ERA'. 'Runs' is the number of runs scored by a team in a season, 'Hits' is the number of hits allowed by a team in a season, 'Home Runs' is the number of home runs scored by a team in a season, 'RBI' is the number of runs batted in for a team in a season, calculated as runs a team scores that were the result of a hit, and 'ERA' is the earned run average, or a team's number of earned runs given up divided by total number of innings pitched. Linda is a baseball statistician and she conducted

some regression analysis on how to predict the winning percentage for a team using the above mentioned five key performance drivers. Using the data for the Major Baseball League in 2010, she generated two Summary Outputs, one for simple regression and another for multiple regression, as shown in the two tables overleaf.

- (i) What is the estimated multiple regression model? Explain what the variables and constants mean, if appropriate. **[2 marks]**
- (ii) Provide and explain a 90% confidence interval for the slope of 'Hits' in the multiple regression equation. **[2 marks]**
- (iii) Use the simple regression equation to predict the winning percentage of a baseball team for which the number of "Runs" in a season is 800. Give a rough 90% prediction interval for the winning percentage. Interpret your result intuitively. **[3 marks]**
- (iv) For the simple regression, explain the relationship between the t-statistic and the p-value for the slope. **[2 marks]**
- (v) Compare the results for the simple regression and the multiple regression and highlight some key differences. **[3 marks]**
- (vi) Explain why you would or why you would not use the generated simple regression and/or the generated multiple regression for predicting the winning percentage for a baseball team. **[3 marks]**

(TURN OVER)

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.562918096							
R Square	0.316876783							
Adjusted R Square	0.292479525							
Standard Error	0.070072404							
Observations	30							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	1	0.063773969	0.063774	12.98821	0.00120187			
Residual	28	0.137483972	0.00491					
Total	29	0.201257941						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	0.061907966	0.122215125	0.506549	0.616437	-0.188438369	0.312254301	-0.14599596	0.269811896
Runs	0.000562158	0.000155985	3.603916	0.001202	0.000242636	0.000881679	0.000296806	0.000827509

SUMMARY OUTPUT								
Regression Statistics								
Multiple R	0.779567615							
R Square	0.607725667							
Adjusted R Square	0.526001847							
Standard Error	0.057354281							
Observations	30							
ANOVA								
	df	SS	MS	F	Significance F			
Regression	5	0.122309617	0.024462	7.436335	0.0002455			
Residual	24	0.078948325	0.00329					
Total	29	0.201257941						
	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 90.0%	Upper 90.0%
Intercept	-0.084204082	0.394281292	-0.21356	0.832691	-0.897961	0.7295525	-0.75877288	0.590364716
Runs	-0.00260361	0.002009053	-1.29594	0.207322	-0.00675	0.0015429	-0.00604086	0.000833643
Hits	0.00066438	0.000300195	2.21316	0.036644	4.481E-05	0.001284	0.00015078	0.001177978
Home Runs	0.000128845	0.0006589	0.195546	0.846611	-0.001231	0.0014887	-0.00099845	0.001256145
RBI	0.002573548	0.002106598	1.221661	0.2337	-0.001774	0.0069214	-0.00103059	0.006177689
ERA	-0.068424851	0.028553456	-2.39638	0.024705	-0.127356	-0.0094934	-0.11727645	-0.01957326

(b) Suppose the daily revenue for a firm is equal to the sum of the daily revenue of its division 1 and the daily revenue of its division 2. The daily revenue of its division 1 and the daily revenue of its division 2 are uncertain and they are correlated with a correlation coefficient r . You are asked to use a Monte Carlo simulation approach to estimate the total annual revenue for the firm.

(i) Describe how you should draw observations of daily revenues in two divisions for the following two scenarios: (1) $r = 0$, (2) $r = -0.9$.
[3 marks]

(ii) Define the flaw of averages. Do you think there is any flaw of averages if we use the sum of the true average revenue for division 1 and the true average revenue for division 2 to estimate the average revenue for the firm? Explain your answer. **[3 marks]**

(c) Consider the decision tree analysis approach.

(i) Define the concept of the expected value of perfect information (EVPI) and briefly describe how you can find EVPI. **[4 marks]**

SECTION B

5 The Beachfront Café is a popular destination for tourists visiting the Norfolk Broads. Upon arrival, a menu board displays the standard menu and daily specials. Customers enter the café, collect a meal tray, and place an order for their food and drinks with a single server (task time 25 seconds). The server provides them with a printed receipt describing their food and drinks selection. Customers move to the hot food section, where they submit their meal docket to one of two meal servers, who prepares their meal (task time 70 seconds).

After receiving their meal, customers collect their hot and cold drinks from one of three self-service automatic drinks dispensers. Observations of the process show that, on average, 80% of customers choose a drink. Each dispenser takes about 30 seconds to provide a drink. Whether customers have selected a drink or not, café policy requires them to maintain their position in the queue.

Finally customers pay at the register. The register operator takes 20 seconds to input their food and beverage selections, and customers then make payment by: contactless card (5 seconds); cash (25 seconds); or by chip-and-pin card (40 seconds). Café records indicate that about 50% use contactless cards, 40% use cash, and 10% use chip-and-pin.

The café usually finds it quite easy to provide a good service to customers. However, during lunch time in summer, long queues are common. As the café manager explains, “Lunch service is particularly chaotic. Customers complain about the wait, and that places enormous stress on our staff.”

(a) Assuming no customers are already in the system, how long (in seconds) will it take for one customer to place an order, collect their meal and drink, and complete payment by contactless card? **[2 marks]**

(b) Determine the capacity per hour for each stage of the process. Which stage is the bottleneck? **[6 marks]**

(TURN OVER)

(c) Calculate the overall labour utilisation rate. Assume demand exceeds capacity, and that the process admits orders at the rate of the bottleneck.

[4 marks]

(d) What changes would you suggest to improve the operational performance of The Beachfront Café? Indicate the effects of your suggestions on the process performance. **[10 marks]**

(e) The café manager collected data for a typical day. This data showed 600 customers dined at the café over a seven-hour period. On average there were 75 customers in the restaurant (in the ordering process or eating at the tables). How long does an average customer spend at The Beachfront Café?

[3 marks]

6 Home Matters (HM) is a regional home improvement speciality retailer. The company operates 25 stores throughout Cambridgeshire, supplied from a central distribution centre located on the outskirts of Cambridge. HM's stores are prominently located in major shopping complexes. Each store offers product quality and range comparable to its main retail competitors. Competition on price is fierce, though HM's prices are slightly higher than its low-cost competitors. In its advertising, HM uses the slogan "You can do it. We can help," and supports this offering with highly trained shop floor staff who can assist customers with any of their home improvement needs. The stores also offer customers a range of free workshops on do-it-yourself projects like painting, installing tiles, and basic carpentry. The company offers a simple, no-fuss returns policy and customers are able to access support from a customer service representative by phone, text or email.

(a) Describe HM's competitive priorities. **[5 marks]**

(b) The CEO of HM is considering adding a trade department to the stores, catering to local builders and tradespeople. Given the information above, would you be supportive of the CEO's initiative? What issues should the CEO consider? **[9 marks]**

The CEO has recently heard about a new technology called 3D printing ('additive manufacturing'), and wondered how it might be applied at the company. Initial investigations, for example, indicate that approximately 5% of items currently held in stock at the distribution centre could instead be printed in response to customer demand.

(c) What benefits might the company expect to achieve from reducing inventory holdings in its distribution centre? **[3 marks]**

(d) Where on the product-process matrix would you position 3D printing? Justify your answer. **[8 marks]**

7 Archer, a five-year old boy, was scheduled to undergo squint correction surgery at a large local hospital. His parents felt relatively well-informed having attended a pre-operative appointment with the Ophthalmology Department a month earlier, and later receiving an information pack from the ward providing guidance for Archer's post-operative care.

On the day of the surgery, however, several issues arose. Although arriving at the hospital early in the morning, no guidance was provided regarding the scheduled time for surgery. This meant that Archer had ample time in the ward's playroom, which was bright, well equipped with toys and games, and staffed by enthusiastic and helpful volunteers.

Back in the ward room, the health care professionals responsible for Archer's care consistently failed to introduce themselves or their role at the hospital. Having been told at the appointment a month earlier that only one eye required surgery, the consultant then informed the parents that in fact both eyes required surgery. The anaesthetist allowed pre-operative drinking fluids for Archer, but failed to communicate this to the nursing staff who were concerned at the deviation from usual practice. Similarly, a lack of communication between the theatre and ward meant Archer was not ready for surgery when theatre staff arrived. Following the surgery, the after-care advice from the ward differed from that in the brochure which had last been updated five years ago.

Thankfully, the surgery went as planned, and in the follow-up appointment a month later, the Consultant Ophthalmologist expressed her delight with the outcome.

(a) Describe and evaluate the technical and functional quality of service received by Archer and his family. **[10 marks]**

(b) Late starts to surgery are a common challenge in effectively utilising operating theatre capacity. The Theatre Manager would like to identify the sources of late starts and undertake an analysis of potential causes. Suggest three basic quality tools and describe how they might be applied to assist in this goal. **[9 marks]**

(c) The variability in patient experience has led the hospital to consider the introduction of service scripts to help standardise the interactions between its frontline staff and patients. What do you see as the pros and cons of using scripts in this context? **[6 marks]**

(TURN OVER)

8 MedCo is a leading manufacturer of medical devices for global markets. Their main product line is expected to achieve over 20% sales growth. However, the upcoming expiry of patents means that the cost of production must be substantially reduced. To achieve this cost reduction, the production site has already taken a number of actions such as moving from a costly four shift, seven day roster to a three shift, five day roster. To make this change viable, while accommodating the anticipated sales growth, the company must achieve a 60% increase in production line capacity. Around half of this improvement is planned to come from capital investment, with the balance from improved productivity.

A number of basic issues common to many manufacturing operations were apparent. First, a value stream map of the production process revealed imbalances in processing times between various key activities, particularly the automated assembly activity and the manual packing activity. This imbalance triggered a wave of work in progress and stop-start operations of filling and packing. Second, management were concerned by the high level of defects and inspection labour involved in checking, correcting or re-working product. Third, management realized that changing shop floor behaviour and leadership behaviour was critical to achieving the required change. Managers, team leaders, and support staff (including maintenance and quality assurance) were all coached on how to provide effective and timely support to the line.

MedCo also faced considerable challenges coordinating a complex network of suppliers dispersed throughout the world. Perhaps their biggest pressure was coping with large week-to-week fluctuations in the size of orders from their key customers, when end-consumer demand for their medical devices was actually relatively stable. MedCo also had a problematic relationship with their key packaging supplier: inventory was delivered monthly in large batches, and often late; poor quality meant incoming inspection of materials was necessary; and the relationship was price-focused and adversarial in nature.

(a) In considering how to improve productivity, the Operations Director had read about Lean Thinking and Six Sigma. He wondered how the underlying goals and approaches of the two process improvement methodologies differ, and turns to you for an explanation. How would you respond? **[8 marks]**

(b) Briefly discuss what lean tools or techniques might help MedCo address the following:

(i) The imbalances in the production line. **[2 marks]**

(ii) The high level of defects. **[2 marks]**

(iii) Coaching of shopfloor teams. **[2 marks]**

(c) What potential explanation might you offer for the fluctuations in ordering patterns observed in MedCo's supply chain? **[4 marks]**

(d) How might MedCo use Lean Thinking to build a more effective relationship with its key packaging supplier? **[7 marks]**

END OF PAPER

SPECIAL DATA SHEET 1

Formula sheet

Standard errors

$$STEM = \frac{\sigma}{\sqrt{n}} \approx \frac{s}{\sqrt{n}}, \quad STEP = \sqrt{\frac{p(1-p)}{n}} \approx \sqrt{\frac{q(1-q)}{n}},$$

$$STEDM = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2}{n_1 + n_2}} \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}.$$

Covariance, Correlation and Regression

Consider data pairs $(X_1, Y_1), (X_2, Y_2), \dots, (X_n, Y_n)$.

Let m_X and m_Y denote the respective means of the X and Y data.

Let s_X and s_Y denote the respective standard deviations of the X and Y data.

Covariance between X and Y is given by

$$\text{cov}(X, Y) = \frac{\sum_{i=1}^n (X_i - m_X)(Y_i - m_Y)}{n} = \frac{\sum_{i=1}^n X_i Y_i}{n} - m_X m_Y$$

The correlation coefficient between X and Y is given by

$$\text{correl}(X, Y) = r = \frac{\text{cov}(X, Y)}{s_X s_Y}.$$

The line of best fit is given by

$$Y - m_Y = \frac{r s_Y}{s_X} (X - m_X).$$

Variance of a portfolio

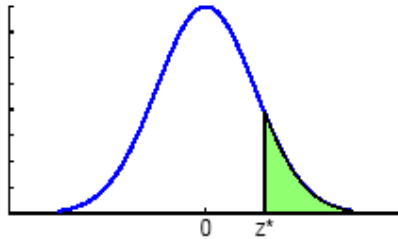
Consider three random variables x, y and z with means m_x, m_y , and m_z , respectively; variances $\text{Var}(x), \text{Var}(y)$, and $\text{Var}(z)$, respectively; and covariance between x and y , for example, given by the formula above. Given any numbers $\alpha_x, \alpha_y, \alpha_z$, let $v = \alpha_x x + \alpha_y y + \alpha_z z$. Then the variance of v is given by

$$\begin{aligned} \text{Var}(v) = & \alpha_x^2 \text{Var}(x) + \alpha_y^2 \text{Var}(y) + \alpha_z^2 \text{Var}(z) \\ & + 2(\alpha_x \alpha_y \text{cov}(x, y) + \alpha_y \alpha_z \text{cov}(y, z) + \alpha_x \alpha_z \text{cov}(x, z)) \end{aligned}$$

SPECIAL DATA SHEET 2

Standard Normal Distribution Table

(Areas under the standard normal curve beyond z^* , i.e., shaded area)



z^*	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641
0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0721	0.0708	0.0694	0.0681
1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
1.8	0.0359	0.0351	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
2.9	0.0019	0.0018	0.0018	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010

Thursday 03 May 2018

9.00 am to 12.00 pm

Paper M3

ECONOMICS WITH ACCOUNTING AND FINANCE

Answer **four** questions, **two** from Section **A**, **one** from Section **B(1)** and **one** from Section **B(2)**.

Answers to Sections **A**, **B(1)** and **B(2)** must appear in **three** separate booklets.

All **eight** questions carry 25 marks each.

STATIONERY REQUIREMENTS

3 x 20 Page Booklets

Rough Work Pads

SPECIAL REQUIREMENTS

Approved calculators allowed

<p>You may not start to read the questions printed on the subsequent pages of this question paper until instructed that you may do so by the Invigilator</p>
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SECTION A

1 (a) Explain and illustrate what is meant by the terms perfect substitutes and perfect complements in consumption. **[5 marks]**

(b) Describe the effects of the introduction of a price ceiling and a price floor in a competitive market. **[10 marks]**

(c) Demonstrate that firm profits are optimised at the level of production where marginal cost equals marginal revenue. **[10 marks]**

2 (a) Define the marginal rate of technical substitution of labour for capital and explain why it is equal to the factor price ratio when a firm chooses the cost-minimising combination of inputs. **[5 marks]**

(b) Define a 'Giffen good' and illustrate your definition by means of an appropriate diagram. **[10 marks]**

(c) Provide an example of a normal-form game that has more than one Nash Equilibrium. **[10 marks]**

3 (a) What are 'normal' and 'inferior' goods? **[5 marks]**

(b) Compare the Cournot and the Stackelberg models of oligopoly. Discuss the implications of their market outcomes for producers and consumers. **[10 marks]**

(c) Define first-, second- and third-degree price discrimination. For each type: give an example of a firm which employs such discrimination and discuss how it is possible to enforce the differential prices. **[10 marks]**

4 (a) State and then comment on the Keynesian expenditure equation for GDP. **[5 marks]**

(b) Using the concept of the multiplier, explain how a reduction in the rate of income tax could increase national income. **[10 marks]**

(TURN OVER)

(c) Define the concept of investment and explain the role of each component of the following investment function:

$$I = I_n [MPK - (P_K/P)(r + \delta)] + \delta K$$

[10 marks]

SECTION B(1) Answer ***EITHER*** Question 5 ***OR*** Question 6

5 On 31 December 2016, Animoji Corporation reported the following Balance Sheet:

Assets		Liabilities	
Cash	£10,000	Accounts Payable	£15,000
Accounts Receivable	£20,000	Notes Payable	£25,000
Land	£120,000	Long Term Loans	£140,000
Equipment (net of £10,000 accumulated depr.)	£90,000	Equity	
Research and Development	£60,000	Share Capital	£110,000
		Retained Earnings	£10,000

During 2017, Animoji had the following transactions occur:

1. Provided consulting services to customers. Billed them for £42,000.
2. Borrowed an additional £40,000, at the end of December 2017, from a bank (to be included in Long Term Loans).
3. Collected £27,000 from the customers billed in transaction 1.
4. Depreciated the equipment by an additional £11,000.
5. Paid £11,000 in cash for internally-generated technological Research and Development during 2017.
6. Paid £2,000 cash for interest due on the Notes Payable and Long Term Loans over the year.
7. Paid employee salaries of £15,000 for work completed during the year.
8. Received bills from the telephone, electric, and water service providers to whom Animoji owes a total of £4,000 for services used up during the year.
9. Impaired Research and Development by £2,000.

Requirements:

(a) Report a 2017 end-of-year Income Statement. **[5 marks]**

(b) Report a 2017 end-of-year updated Balance Sheet. **[5 marks]**

(c) What was the total change in the balance of Cash from the end of 2016 to the end of 2017? **[1 mark]**

(d) How much were the Cash Flows from Financing for the year of 2017? (Note: you do not have to prepare the entire Statement of Cash Flows to answer this question, but you are welcome to do so if it might help). **[2 marks]**

(e) How much were the Cash Flows from Investing for the year of 2017? (Note: you do not have to prepare the entire Statement of Cash Flows to answer this question, but you are welcome to do so if it might help). **[2 marks]**

(f) How much were the Cash Flows from Operations for the year of 2017? (Note: you do not have to prepare the entire Statement of Cash Flows to answer this question, but you are welcome to do so if it might help). **[2 marks]**

(g) What is your interpretation of the overall financial health of this company? Please explain your answer with a few sentences to support your interpretation. **[3 marks]**

(h) Explain how Animoji Corporation was able to recognize an asset called "Research and Development." What does this asset represent? **[2 marks]**

(i) Assume that Gobble-Up Corporation buys all of the shares of Animoji Corporation immediately after Animoji presents its 31 December 2017 financial reports. Gobble-Up chooses to pay £300,000 for the entire company. In fewer than 1,000 words, describe how much you think Gobble-Up will report as Goodwill that relates to this purchase. How did you arrive at this estimate? What assumptions did you need to make? If this were a real scenario, who might you hire as consultants to help with this estimate? **[3 marks]**

6 In its 2016 annual report, Easyjet reports the following:

Revenue recognition










Revenue comprises seat revenue, being the value of airline services (net of air passenger duty and similar charges, VAT and discounts), and non-seat revenue. Seat revenue arises from the sale of flight seats, including the provision of checked baggage, allocated seating, administration, credit card and change fees. Seat revenue is recognised when the service is provided. This is generally when the flight takes place, but in the following cases, this is at the time of booking:

(TURN OVER)

- *administration and credit card fees as they are contractually non-refundable; and*
- *change fees as the service provided is that of allowing customers to change bookings.*

Amounts paid by 'no-show' customers are recognised as seat revenue when the booked service is provided as such customers are not generally entitled to change flights or seek refunds once a flight has departed. Unearned revenue represents flight seats, including the provision of checked baggage and allocated seating, sold but not yet flown and is held in the statement of financial position until it is realised in the income statement when the service is provided. Non-seat revenue arises from commissions earned from services sold on behalf of partners and is recognised when the service is provided. This is generally when the related flight takes place. In the case of commission earned from travel insurance, revenue is recognised at the time of booking as easyJet acts solely as appointed representative of the insurance company.

Assume you pay £195.77 on 1 December 2017 for this flight itinerary (including options):

 £195.77 Pay by Debit Card/Other	
London Gatwick to Santorini	
EZY8765 	
Departure 06:35 Wed 11th Apr	
Arrival 12:30	
Your fares	
Adult	1 x £50.49 
Your flight options	
Extra Legroom seat	1 x £21.49 
Santorini to London Gatwick	
EZY8766 	
Departure 13:10 Fri 13th Apr	
Arrival 15:10	
Your fares	
Adult	1 x £50.06 
Your flight options	
Extra Legroom seat	1 x £25.49 
Hold items	
15kg hold bag	1 x £40.73 
Combined weight 15kg	
Your travel extras	
Travel Insurance	
Comprehensive plus cancellation cover	£7.51 
Total	£7.51

Requirements:

(a) What happens when a company collects cash but has not yet earned the right to recognise that as revenue? **[2 marks]**

(b) When should Easyjet recognise the revenue associated with this travel, scheduled for April 2018? Please explain your answers and why they agree or disagree with Easyjet's stated revenue policies. **[8 marks]**

(c) Assume Easyjet starts selling electronic merchandise (e.g., cameras, GPS units, and headphones) to interested passengers on its flights. How should it recognise revenue for these transactions? **[3 marks]**

(TURN OVER)

In a financial report dated 25 March 2014, King Digital Entertainment PLC (which makes online games, such as “Candy Crush”) stated the following:

“Mobile and Social Platforms

We offer our games on mobile and social platforms, whereby players can play games for free, though they can purchase in-game virtual items. Virtual items provide various game enhancements such as boosting player ability or extending game play and are not transferable between different games. Virtual items are classified into two categories: consumable or durable, depending on whether the virtual item’s value is consumed immediately or if the item has an ongoing value in game play. Our data systems can differentiate between revenue generated from durable and consumable items for games offered on mobile and social platforms.

Consumable items provide a benefit to the player that is consumed by a specific player action, after which the consumable items are no longer available for reuse in future game play. Consumable goods are eliminated from the player’s game board after they have been consumed and do not provide the player with any continuing benefit following their consumption. Consumable items can be purchased in a single item format or a multiple item pack. Revenue is recognized at the time the item is consumed for single item formats and is recognized at the time the final item in a multiple item pack is consumed, which approximates its time of purchase.

Durable items are used by players from the time of purchase onward. They provide game enhancement throughout play and do not immediately expire. The enhancement or benefit ends at the earliest of a player completing or abandoning the game. We recognize revenue from the sale of durable virtual items ratably over the estimated average playing period of paying players on that specific game, which is typically between two and nine months depending on the game. The average playing period of paying players on a specific game is our best estimate of the average life of a durable item sold in that game. We reassess the estimated average life of durable items on a periodic basis, which is typically every quarter.

We determine, on a game by game basis, the estimated average playing period begins when a player makes a first purchase, and ends when a player is determined to be inactive. Based on an assessment of the historical pattern of players’ game play, we consider a paying player inactive if that player has not logged on to a game in any one month. The rate by which paying players become inactive for any given month is calculated to be the proportion of players who have purchased at least one virtual item in any previous month, who were active in the previous month and who have not logged in to the gaming environment during that given month. Through this analysis we have determined that players become inactive at a relatively consistent rate. Based on this consistent rate, we determine the estimated average playing period of a paying player by computing the average amount of time that a paying playing will remain active. If future data indicates paying players do not become

inactive at a relatively consistent rate, we revise our method of calculation accordingly.”

(d) What do you think about the credibility of this stated revenue recognition policy for consumable goods and for durable goods? Do you think it correctly reports the true underlying economics of the transaction to stakeholders? **[8 marks]**

(e) [Hypothetical only—we should avoid presumptively accusing any given management team of unethical or illegal behavior]: Assume the top executives at this company were concerned about whether they would have sufficient earnings for a given period to earn their annual compensation bonuses. What adjustment(s) could they make to ensure they would earn more earnings for the period? What mechanisms are in place to try to prevent this behaviour? **[4 marks]**

SECTION B(2) Answer ***EITHER*** Question 7 **OR** Question 8

7 (a) A bond is sold at \$923.14 (below its par value of \$1,000). The bond matures in 15 years and has a 10% yield-to-maturity, expressed as a stated annual interest rate, compounded semiannually. What is the coupon rate on the bond if the coupon is paid semiannually? The next payment occurs six months from today. **[13 marks]**

(b) Trumpington Mineral Water plc will pay a quarterly dividend per share of £1 at the end of each of the next 12 quarters. Thereafter, the dividend will grow at a quarterly rate of 0.5% forever. The appropriate rate of return on the stock is 10%, compounded quarterly. What is the current stock price? **[12 marks]**

8 Browns Ltd is considering a four-year project to manufacture high-tech garage door openers. This project requires an initial investment of £8 million that will be depreciated straight-line to zero over the project's life. An initial investment in net working capital of £2 million is required to support spare parts inventory; this cost is fully recoverable whenever the project ends. The company believes it can generate £7 million in pretax revenues with £3 million in total pretax operating costs. The tax rate is 38% and the discount rate is 16%. The (resale) market value of the equipment over the life of the project is as follows:

(TURN OVER)

Year	Market Value (£ millions)
1	6.50
2	6.00
3	3.00
4	0.50

Note: Pretax operating costs do not include depreciation.

(a) Assuming Browns Ltd operates this project for four years, what is the NPV? **[10 marks]**

(b) Compute the project's NPV:

(i) if the project is abandoned after only one year

(ii) if the project is abandoned after two years

(iii) if the project is abandoned after three years

[12 marks]

(c) Comment on what economic life for this project maximises its value to the firm? **[3 marks]**

END OF PAPER