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Sergio Sousa

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Karina Terry
Centre for Decision Research and Experimental Economics
School of Economics
University of Nottingham
University Park
Nottingham
NG7 2RD
Tel: +44 (0) 115 95 15620
Fax: +44 (0) 115 95 14159
karina.terry@nottingham.ac.uk

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Are smarter people really less risk averse?

Sergio Sousa[1]

Department of Economics, University of Sao Paulo
School of Economics, Business and Accounting (FEA-USP)
Sao Paulo 05508-900, Brazil
e-mail: ssousa@usp.br

Abstract

Using hypothetical lottery choices to measure risk preferences, Frederick (2005) finds that higher cognitive ability is associated with less risk aversion. This paper documents, however, that when using an incentive compatible measure of risk preference, attitudes towards risk are not associated to cognitive ability as measured by Frederick's (2005) three-item cognitive reflection test. This is a new finding that adds weight to the claim that lack of proper financial incentives can sometimes be a source of bias. In addition, we show that this lack of association between risk preferences and cognitive ability is robust to using a broader measure of cognitive ability that takes into account both verbal and non-verbal reasoning skills. Our results suggest the possibility that whether cognitive ability relates to attitudes towards risk is sensitive to instruments used to measure both of them.

Keywords: cognitive ability, risk preferences, financial incentives, cognitive reflection test

JEL Classification: C91, D01, D80, D00

1. Introduction

There is a growing literature showing that cognitive ability can account, at least in part, for a variety of behaviors that are of central importance for economic theory and policy. Examples include risk preferences, time discounting, choices in dominance-solvable games, wealth, retirement income, and even schooling, employment and occupation choices[2]. In an important and seminal contribution to this literature on cognitive ability and economic behaviour, Frederick (2005) finds that individuals with the highest score in his three-item cognitive test are significantly less risk averse. This work has been widely cited and the test used by many as an instrument

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[2]See for example, Frederick (2005), Benjamin *et al.* (2006), Burks *et al.* (2009), and Sunde *et al.* (2010) for risk and time preferences; Rydval *et al.* (2009) and Burnham *et al.* (2009) for behavior in dominance-solvable games, and Cawley *et al.* (2001); Smith *et al.* (2010) for wealth; Banks *et al.* (2010) for retirement income, and Heckman *et al.* (2006) for schooling and labor outcomes.

to measure cognitive skills[3] A key feature of this study is that risk preferences are elicited through a series of choices over lotteries with hypothetical monetary payoffs. It is no longer novel, however, that this elicitation method can be problmeatic. Economists have long believed that people respond to incentives and that not rewarding subjects for task completion may severely bias choice decisions; hence, risky choices in a hypothetical setting may not accurately represent risk-taking behaviour as compared to situations where individual are given incentives to think hard and answer truthfully.

In this paper, we test the robustness of Frederick's (2005) results to using a incentive-compatible procedure to elicit risk preferences. We also examine whether risk preferences are related to cognitive ability when this latter is measured through a test that captures several skills and not only impulsive thinking. We find that individuals with higher scores in Frederick's (2005) test are not less risk-averse than individuals with lower scores. More important, perhaps, we find that risk preferences are not systematically related to cognitive ability even when this latter is measured through a cognitive test that captures several reasoning skills.

This paper contributes to this nascent literature on cognitive ability and economic behavior in two respects. First, we examine the strength of previous findings. While there is an apparent disinterest in scientific replications in the profession, we believe that these studies on cognitive ability and economic behavior need to be replicated with different subject groups and cognitive tests before the underlying association is to be believed. Second, we directly test cognitive ability using an instrument that measures several reasoning skills. This is an alternative to tests that only capture a single reasoning skill, such as abstract reasoning in a geometric context or quantitative literacy.

The remainder of the paper is structured as follows: Sections 2 and 3 describe our design and data analysis procedures, respectively. Section 4 shows the results. Section 5 concludes.

2. Experimental Design

The experiment consists of a set of risk-elicitation tasks and a cognitive test. First, subjects face a sequence of six choice tasks designed to elicit their risk attitudes. Then, they are asked to complete a cognitive test. In this section, the risk-elicitation tasks and the cognitive test used in this experiment are briefly described and subject pool and procedures are summarized[4].

2.1. Risk-elicitation tasks

The question of how to elicit people's attitudes to risk is addressed via a Multiple Price List procedure. This method has been widely used to elicit risk attitudes in laboratory experiments (e.g., Holt & Laury, 2002; Harrison *et al.* , 2007; Offerman & Schotter, 2009) and involves an easily understandable task. In each risk-elicitation task we implement, a subject faces a number of pairwise choice problems. Each problem is to choose between a given lottery L (a p chance to win x and $1 - p$ to win y, where $x > y > 0$) and an amount of money with certainty; the certain money option is systematically decreased from x to y by a constant amount, say δ, when proceeding down the table. So, in the first row the decision problem an individual faces is to choose between x for sure and L. In the second row it would be a choice between $x - \delta$ for sure

[3] See for example Oechssler *et al.* (2009), Huysentruyt & Read (2010), Campitelli & Labollita (2010), and Bergman *et al.* (2010).

[4] Instructions are available upon request.

and L, and so on until the sure thing equals y, the lower payoff yielded by the lottery L. Because the difference between the sure sum and the expected value of the risky option decreases and turns negative from some point on, even a very risk-averse individual is expected to switch over to the lottery at some row when going down the table.

Subjects face a sequence of six of such risk-elicitation tasks. Table 1 below presents the set of lotteries used in each of these risk tasks in the order they are presented[5]:

Table 1: Lottery option per risk-elicitation task

Lottery	Payoff 1	Pr(Payoff 1)	Payoff 2	Pr(Payoff 2)	EV	Rows
L1	8	0.2	4	0.8	4.8	17
L2	9	0.2	3	0.8	4.2	25
L3	6	0.4	3	0.6	4.2	13
L4	9	0.3	4	0.7	5.5	21
L5	16	0.2	10	0.8	11.2	25
L6	6	0.4	3	0.6	4.2	13

2.2. *Cognitive test*

Like other psychometric tests, our cognitive test is a set of questions that seek to assess a range of reasoning skills. The test contains twelve questions divided into four sections: one on each of mathematical, verbal and sequential reasoning; plus the three-item cognitive reflection test proposed by Frederick (2005)[6]. Subjects are given one minute to complete each question included in the test as they are presented on the computer screen. Subjects are told that performance in the cognitive test has no effect whatsoever on their earnings.

We measure cognitive ability with scores obtained in this test. An individual's cognitive score is simply the total number of correct answers. Like many other tests, this test measures relatively abstract reasoning skills. The mathematical section picks up problem solving skills involving basic understanding of arithmetic and algebra. The verbal section tries to measure ability to analyse parts of sentences, and recognise the relationship between words and literary concepts. The sequential reasoning section, in turn, covers analysis of patterns and deductive reasoning in arithmetic and geometric context. The cognitive reflection test (Frederick, 2005) captures one's ability to resist reporting intuitive answers that first spring to mind; it tries to measure individuals' ability to be more reflective and exert conscious deliberation upon making decisions as opposed to decisions executed effortlessly and instantly on an intuitive basis.

Since it is apparent that one's performance in this test involves a command of skills developed over many years of education, performance in cognitive test is likely to be shaped by individual's successful school learning. While this depends on many personal characteristics other than intelligence, school performance is shown to be correlated with scores on psychometric tests to measure cognitive skills (Mayes *et al.* , 2009). Thus, like several measures of scholastic achievement, this cognitive test is likely to be picking up individual's general cognitive ability as well. Also, relative to the general population subjects in this study are likely to be less heterogeneous

[5]For roughly half of the subjects; for the other half the order of L2 ad L5 is reversed. The purpose is to perform a small-scale test of order effects. We do not reject the hypothesis that there is no order effect on elicited risk attitudes.

[6]See Appendix for the complete test.

in their schooling success; thus differences in cognitive ability within our sample may be more influenced by "raw" cognitive ability than they would be in a randomly selected sample from the general population.

2.3. Subject pool, resolution of risk, and earnings

A total of 106 subjects were recruited on a first-come first-served basis to take part in the experiment[7]. Most are undergraduate students from different disciplines with a median age of 20 (ranging from 18 to 25 years).

Subjects were informed prior to completing any task that they would make several paired lottery choices, but only one of these choices would be selected at random at the end of the experiment to determine their earnings[8]. Earnings were determined according to the option they chose in the selected choice problem. If they chose Option A, they receive the amount of money it specifies, whereas if they chose Option B, the risky option, they play the lottery; risk is resolved by drawing a chip from a bag containing 10 numbered chips and receiving the payoff according to what the lottery specifies [9]. On average, experimental sessions lasted around one hour and average earnings were 6.70 British pounds.

3. Data Analysis

We combine choice data from risk tasks to build up a simple measure of risk aversion. Then we perform several statistical tests on this measure to compare results for individuals with high cognitive ability with those for individuals with low cognitive ability.

We use the risk-premium for the lottery option as a measure of the individual's risk aversion in a given risk task. The risk premium for a lottery L is the certain amount of money an individual would forego in order to avoid the risk inherent in L. This is a simple and non-parametric measure of risk preference based on the subject's discrete choices. Recall that a subject's *switching point* in a given risk task provides a fairly narrow interval within each the amount of money that for her is as good as taking the gamble must fall into – that is, her certainty-equivalent for the lottery. For simplicity, assume that that such certainty equivalent is just the midpoint of such monetary interval. The risk premium is calculated by subtracting the certainty equivalent from the expected value of the lottery.

We summarise the risk aversion of a subject in the experiment by computing her *risk-score*, which will simply be the average risk premium for the lottery options in each risk task. Thus, a subject's *risk-score* can range from a positive number, indicating a degree of risk lovingness, to a negative number, indicating a degree of risk aversion. The *risk score* takes value zero in case of a consistently risk neutral individual. From an ordinal point of view, this measure is isomorphic to a coefficient of relative risk aversion that rationalize the choices the individuals made.

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[7]Participants were recruited using ORSEE (Greiner, 2004).

[8]This is known as the random-lottery system, which allows an incentive-compatible elicitation of individual choices in multiple-task settings avoiding income effects (Lee, 2008).

[9]Probabilities in the lotteries are replaced by numbers. For example: if the lottery has two prizes, A and B, with probability 0.3 and 0.7, respectively, then A is paid if the chip drawn is numbered 1 to 3, whereas B is paid if the chip is numbered 4 to 10.

4. Results

We begin by asking how individuals' risk preferences are related to their cognitive ability. We try to replicate Frederick's (2005) results regarding risk preferences, but under incentive-compatible conditions. We also test whether the association between cognitive ability and risk attitudes is robust to more general measures of cognitive ability. Thus, we consider two measures of cognitive ability: Frederick's (2005) three-item cognitive reflection test (CRT) and our full cognitive test that assess verbal and non-verbal reasoning skills.

Table 2 presents average risk scores per cognitive group. In the Full Cognitive Test panel, subjects are divided into two cognitive groups: the "high" score group includes subjects who scored above the median score, while the "low" score group includes those who scored below (or equal to) the median score in our full test. In the Cognitive Reflection Test panel, we follow Frederick's (2005) analysis and re-divide the sample between two "extreme" groups: those who scored three out of three ("high") and those who scored scored zero out of three ("low") in the CRT.

Table 2: Average risk score by cognitive group

	Cognitive Reflection Test			*Full Cognitive Test*		
Cognitive Groups	*High*	*Low*	*Kurskal-Wallis*	*High*	*Low*	*Kurskal-Wallis*
Average Risk Score	-0.34 (0.362)	-0.58 (0.683)	$\chi^2 = 2.474$ $p = 0.116$	-0.52 (0.441)	-0.53 (0.711)	$\chi^2 = 0.008$ $p = 0.927$

Notes: Following Frederick (2005), High and Low cognitive groups in the *Cognitive Reflection Test* are those who scored 0 out of 3 ("low") and 3 out of 3 ("high"), respectively. In the *Full Cognitive Test*, High and Low cognitive groups are those who, respectively, scored below the median score ("low") and equal or above the median score ("high"). Standard deviations reported in parenthesis.

From Table 2, one can see that high cognitive ability subjects are, on average, slightly closer to risk neutrality than low cognitive ability subjects. It is also noticeable that while differences in risk preferences between cognitive groups are more pronounced under Frederick's (2005) cognitive classification, which involves groups with extreme test scores, these differences are not statistically significant. A Kruskal-Wallis test reported on the rightmost columns of each cognitive test panel shows that we cannot reject the hypothesis that both cognitive groups have a similar pattern of distribution of risk scores; and this is so regardless of the cognitive test used. Hence, to a first approximation, Frederick's (2005) results showing that risk preferences are related to cognitive ability appear not to be robust to using an incentivised risk-elicitation procedure – a feature absent in his design.

To examine if these results are robust to using less aggregate measures of risk preferences, we do further non-parametric tests at a risk-task level. Tables 3 and .4 report, for each cognitive test, the average risk premium per risk task. The rightmost column of each table reports non-parametric statistics (Mann-Whitney) which test for two-sample distributional differences. Results confirm that there is no statistically significant association between cognitive ability and risk attitudes even at a risk-task level. More importantly, tests statistics support the inference drew from Table 2 showing that Frederick's (2005) results regarding the relationship between risk preferences and cognitive ability appears to be sensitive to the risk-elicitation procedure used: using an incentive compatible risk-elicitation procedure, we find evidence that those who scored higher on the CRT were not more or less risk-averse than those with the lowest scores.[10]

Table 3: Full Cognitive Test: Average risk score per risk task, by cognitive group

	Average Risk Premium		*Statistical significance*
First stage[1]	***"Low Score"***	***"High Score"***	***Mann-Whitney Test***
L1 (£8,0.2;£4)	-0.481 (0.728)	-0.460 (0.513)	Z = -0.158 (p = 0.874)
L2 (£9,0.2;£3)	-0.818 (1.173)	-0.635 (0.704)	Z = -0.364 (p = 0.716)
L3 (£6,0.4;£3)	-0.126 (0.534)	-0.200 (0.399)	Z = 0.853 (p = 0.393)
L4 (£9,0.3;£4)	-0.397 (1.044)	-0.445 (0.640)	Z = 0.799 (p = 0.424)
L5 (£16,0.2;£10)	-1.193 (1.758)	-1.110 (1.417)	Z = -0.238 (p = 0.811)
L6 (£6,0.4;£3)	-0.143 (0.595)	-0.225 (0.410)	Z = 0.972 (p = 0.331)

Notes: Standard deviations reported in parenthesis. p-values are two-tailed. * p < 0.10, ** p < 0.05, *** p < 0.01. Mann-Whitney test's null hypothesis is that distribution of risk scores does not differ between the "high" and "low" score groups.

4.1. Regression analysis

The results of the non-parametric tests are robust to controlling for some observed individual characteristics. Regressing the measures of risk aversion on measures of cognitive ability and controls which include sex, parental education, income levels, and age, the coefficient on cognitive ability is statistically insignificant ($p < 0.001$).

We examine four different model specifications. Model I is the baseline one, where a subject's risk score is used as his measure of risk aversion and the performance in the cognitive test (not including the CRT module) is used as a measure of cognitive ability. The other three models check whether the the baseline results are robust to using either different measures of cognitive ability or different measures of risk aversion as dependent variables. Model II uses the CRT score as the measure of cognitive ability. Models III and IV use a self-reported measure of willingness to take risks[11] (WTR) as dependent variable, while using either our cognitive test score (without

[10] Parametric tests (unreported) show that this result holds when we compare risk scores of subjects divided according to their performance on other components of our test – the quantitative, verbal and sequential, reasoning sections.

[11] Where 0 indicates "unwilling to take risks" and 10 indicates "very willing to take risk". This information was collected through a short socio-demographic questionnaire that subject were asked to answer at the end of the experiment.

Table 4: Cognitive Reflection Test: Average risk score per risk task, by cognitive group

	Average Risk Premium		*Statistical significance*
First stage[1]	*"Low Score"*	*"High Score"*	*Mann-Whitney Test*
L1 (£8,0.2;£4)	-0.511 (0.750)	-0.242 (0.415)	Z = -1.124 (p = 0.261)
L2 (£9,0.2;£3)	-0.808 (1.100)	-0.425 (0.467)	Z = -0.809 (p = 0.418)
L3 (£6,0.4;£3)	-0.190 (0.530)	-0.092 (0.279)	Z = -0.595 (p = 0.551)
L4 (£9,0.3;£4)	-0.470 (1.053)	-0.264 (0.601)	Z = -0.574 (p = 0.566)
L5 (£16,0.2;£10)	-1.345 (1.887)	-0.842 (0.968)	Z = -0.852 (p = 0.394)
L6 (£6,0.4;£3)	-0.154 (0.611)	-0.119 (0.410)	Z = -0.068 (p = 0.945)

Notes: Standard deviations reported in parenthesis. p-values are two-tailed. * p < 0.10, ** p < 0.05, *** p < 0.01. Mann-Whitney test's null hypothesis is that distribution of risk scores does not differ between the "high" and "low" score groups.

the the CRT module) or the CRT score as measures of cognitive ability. This is to check whether the results of the baseline model are robust to using a simple survey question to measure subjects' willingness to take risks.

Table 5 reports OLS estimates of the four model specifications. The second and third columns present the coefficient estimates of models I and II, respectively. The two remaining columns present the estimates of specification III and IV of the baseline model. The point estimate on the *SCORE* variable suggests that a better performance in the cognitive tests does not lead to a statistically significant change in attitudes towards risk. In models I-IV, the parameter estimates of the effect of cognitive ability on risk attitudes are slightly different from zero; yet the hypothesis that they are basically zero cannot be rejected. Similarly, in models II and IV in which cognitive ability is measured by the CRT, the estimated coefficients describing the effect of cognitive ability on risk scores are very similar to those found in the other models and equally not significantly different from zero. Thus, results based on WTR corroborate those based on the risk score. Estimates across all four specifications confirm the non-parametric results shown before. In general, demographic variable have little explanatory power. An exception is models III and IV where gender is significant. Based on those models, female subjects are more risk averse than male ones. We summarize our results below:

Result *Using Frederick's (2005) Cognitive Reflection Test to measure individuals' cognitive skills and incentive compatible measures of risk preferences, we find that there is no difference in risk attitudes between "high" and "low" cognitive score groups. Risk aversion is not related to cognitive ability. This holds true even when we use a broader measure of cognitive ability.*

Table 5: Determinants of individuals' Risk Score (OLS Regressions)

Dependent variable:	Risk Score	Risk Score	WTR	WTR
	(I)	(II)	(III)	(IV)
Constant	0.034	-0.213	6.341***	6.277***
	(0.941)	(0.952)	(2.175)	(2.146)
Score	-0.017	0.060	-0.107	-0.205
	(0.046)	(0.055)	(0.145)	(0.217)
Female dummy	0.019	0.039	-0.618*	-0.621*
	(0.115)	(0.116)	(0.333)	(0.342)
Age	-0.022	-0.016	0.017	0.004
	(0.046)	(0.048)	(0.103)	(0.103)
High income dummy	-0.131	-0.153	0.010	0.050
	(0.137)	(0.136)	(0.373)	(0.378)
Parental education dummy	-0.086	-0.104	-0.480	-0.404
	(0.131)	(0.136)	(0.347)	(0.375)
Observations	106	106	106	106
R-squared	0.017	0.025	0.047	0.054

Note: Heteroskedasticity-robust standard error in parentheses. . * Statistically significant at the 10% level. ** Statistically significant at the 5% level. *** Statistically significant at the 1% level. SCORE is a subject's measure of cognitive ability. In models I and III, this is a subject's overall score in the cognitive test subtracted from her score in the cognitive reflection test (CRT). In models II and IV, this is a subject's score in the CRT only. "High income" dummy takes the value of 1 if the subject reported receiving an average monthly amount of money above one thousand pounds (answers 3-6 in Question 6 of socio-demographic questionnaire (SDQ); see Appendix), and value of 0 otherwise. "Parental education" dummy takes the value of 1 if the subject reported that the head of her family attained a postgraduate level of education (answers 4 and 5 in Question 8 of SDQ).

4.2. Discussion

It is natural to ask why these results depart from most of the previous studies which report that risk aversion over small gambles is less common among individuals with higher scores in cognitive tests (Frederick,2005; Benjamin *et al.* ,2006; Burks *et al.* ,2009; Sunde *et al.* ,2010)[12]. While a systematic analysis of this issue is beyond the scope of this article, we conjecture that such differences are stemming from variation across elicitation methods and cognitive tests used. The risk-elicitation procedure employed here, for instance, differs from Frederick (2005) in using an incentive-compatible mechanism to elicit risk attitudes, but uses the same measure of cognitive ability – along with others. Sunde *et al.* (2010) use the same multiple-price list method used here to elicit risk attitudes, but they use a different test (a symbol-digit correspondence test and a word fluency test) to measure cognitive ability. We measure cognitive ability directly, while Benjamin *et al.* (2006) uses standardized test scores as measures of cognitive ability. Our risk measures can distinguish between degrees of risk aversion or risk-lovingness and all subjects got paid for their decisions, while Oechssler *et al.* (2009) uses a single question to measure risk aversion in the domain of gains and payment for risky decisions is only received by 1% of their subjects. As one can see, there is great methodological variation across studies in this area that make them hardly comparable. Altogether, this suggests that the relationship between cognitive ability and risk attitudes, and possibly other types of economic preferences, might be sensitive to intelligence and preference measurement methods used.

5. Concluding remarks

The goal of this paper was twofold. First, to examine whether Frederick's (2005) results, suggesting smarter individuals are less risk averse, are robust to using incentive compatible measures of risk preferences – his elicitation of risk preferences is based on hypothetical choices. Second, to investigate whether individuals' risk preferences are systematically related to cognitive ability when this latter is measured directly through a broader psychometric test that assess verbal and non-verbal reasoning skills – and not only the ability to suppress intuitive but erroneous thinking.

We presented evidence showing that when using an incentive compatible measure of risk preference, attitudes towards risk are not associated to cognitive ability as measured by Frederick's (2005) cognitive reflection test. This is a new finding that adds weight to the claim that lack of proper financial incentives can sometimes be a source of bias. Furthermore, we found no statistically significant association between cognitive ability and risk preferences even when we use a broader measure of cognitive ability that takes into account both verbal and non-verbal reasoning skills. Altogether, these results suggest that people with higher cognitive ability are as risk-averse as people with lower cognitive ability.

We interpret our results as being consistent with cognitive models that posit that people use two brain systems to make decisions; one is instinctive and often driven by emotions, while the other is conscious and rational (Kahneman & Frederick, 2002; Stanovich & West, 2008). According to these models, some decision tasks will give cues to some individuals that a heuristically primed response needs to be overridden and an analytically derived choice substituted. The association of cognitive ability and performance in these decision tasks stems from the failure of

[12] Our results are consistent with a study by Braas-Garza *et al.* (2008), who find that individual math skills are unrelated to risk attitudes.

lower cognitive ability individuals in performing such overriding[13]. Note that risk-elicitation tasks used in laboratory experiments are purposefully simple; nothing in them suggests that choices are to involve anything other than the expression of purely personal preferences. It is arguably the case then that in expressing their risk preferences through choices in these decision tasks, individuals do not perceive their decisions as heuristically based answers that need to be overridden by an analytic reasoning process. If that is the case, cognitive capacity would have little bearing on the expression of risk preferences as typically elicited in laboratory experiments. Indeed, this is what we found out. But we merely speculate with regard to this explanation and hope that experimental economists will more fully explore the apparent contradictions between our result and findings documented elsewhere. Thus, we see our paper as complementary to this recent literature on the association of cognitive ability and economic preferences, suggesting further research on the sensitivity of the association between risk preferences and cognitive ability to cognition and risk elicitation methods.

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[13] Either because "mindware" is not available or, even when necessity for override is detected and mindware is available, the individual cannot carry out "cognitive decoupling" (Stanovich & West, 2008, p.687).

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Appendix. Cognitive test

Part I: Cognitive Reflection Test[14]

Solve each of the following problems and then type in or choose your answer.
Question 1: A bat and a ball cost £1.10 in total. The bat costs £1.00 more than the ball. How much does the ball cost?
Question 2: If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
Question 3: In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Part II: Part II: Quantitative Reasoning

Question 4: A fish tank is half full of water. When 10 gallons are added, the tank is 6/8 full. What is the capacity of the tank in gallons?

(A) 30 gallons

(B) 40 gallons

(C) 50 gallons

(D) 60 gallons

(E) 80 gallons

Question 5: If a dealer had sold a stereo for £600, he would have made a 20% profit. Instead, the dealer sold it for a 40% loss. At what price was the stereo sold?

(A) £300

(B) £315

(C) £372

[14] Such labels for pats of the test were not disclosed. Subjects were also not told the type of reasoning being assessed by each part of the test.

(D) £400

(E) £440

Question 6: x and y are integers such that $x + y < 11$, and $x > 6$. What is the smallest possible value of $x - y$?

(A) 1

(B) 2

(C) -2

(D) 4

(E) -4

Part III: Sequential Reasoning

Question 7: Determine the number that should come next in the following series:
3 8 14 21 29 38 ?

(A) 46

(B) 42

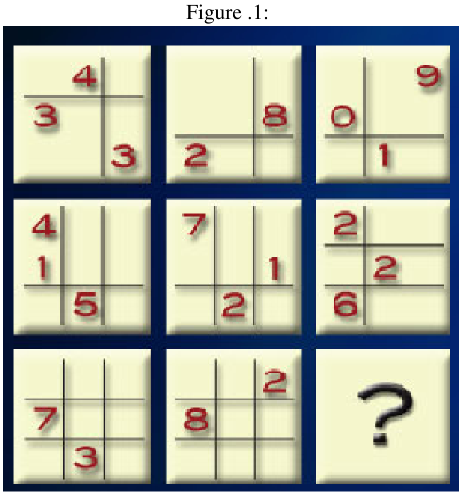
(C) 51

(D) 54

(E) 48

Question 8: Determine the missing square:

Figure .1:



Question 9: Determine the missing square:

Figure .2: Question 8: Answer options

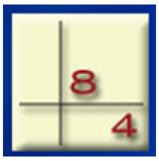
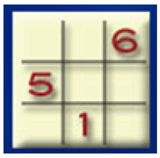
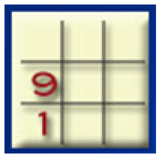
(A)	(B)	(C)	(D)
			
( )	( )	( )	( )

Figure .3:

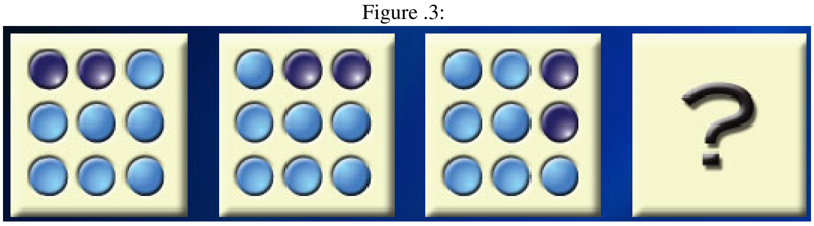
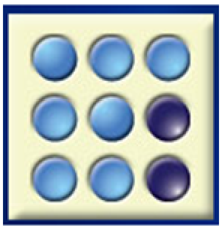
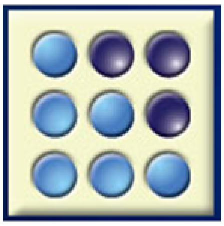
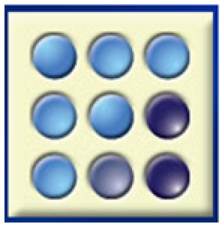


Figure .4: Question 9: Answer options

(A)	(B)	(C)	(D)
			
( )	( )	( )	( )

Part IV: Verbal Reasoning

Section A (Analogies): Choose the answer key which contains a pair of words with a relationship most similar to the relationship between the pair of words in capital letters.
Question 10: *ARCHIVE : RECORDS*

(A) arsenal : arms

(B) locker : uniform

(C) box : shoes

(D) pantry : bread

(E) arsenide : death

Section B (Antonyms): Choose the answer key corresponding to the word with a meaning most nearly opposite to the meaning of the word in capital letters.
Question 11: *CENSURE*

(A) proceed

(B) freedom

(C) praise

(D) enclosure

(E) interest

Section C (Sentence Completion): Choose the choice that contains the words that best complete the sentence.
Question 12: To reach Simonville, the traveller needs to drive with extreme caution along the ——- curves of the mountain road that climbs ——- to the summit.

(A) jagged - steadily

(B) serpentine - steeply

(C) gentle - precipitously

(D) shady - steadily

(E) hair-raising - languidly