MAT 2377C
Midterm exam
Version B

31 October 2012 **Professor: Rafal Kulik**
Time: 70 minutes

Student Number: _____

Family Name: _____

First Name: _____

This is a closed book examination.
Only non-programmable and non-graphic calculators are permitted.
Record your answer to each question in the table below.
Number of pages: **7** (one title page, two pages with questions, two pages of formulas and two pages of tables).
Number of questions: **10**.
NOTE: At the end of the examination, hand in only this page. You may keep the questionnaire.

Question	Answer
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Q1. A company's warranty document states that the probability that a new swimming pool requires some repairs within the first year is 20%. What is the probability, that the sixth sold pool is the first one which requires some repairs within the first year?

(a) 0.6068 (b) 0.3932 (c) 0.9345

(d) 0.0655 (e) none of the preceding

Q2. Let X be a discrete random variable with values $0, 1, 2$ and associated probabilities given by the table below:

x	0	1	2
$P(X = x)$	0.5	0.3	0.2

(a) $E(X) = 0.7$, $\text{Var}(X) = 0.61$ (b) $E(X) = 0.7$, $\text{Var}(X) = 1.1$

(c) $E(X) = 1.3$, $\text{Var}(X) = 0.61$ (d) $E(X) = 0.4$, $\text{Var}(X) = 0.3$

Q3. The probability that a drug A is efficient for the treatment of ear infections is 0.75. For drug B, this probability is 0.55. A large clinical trial is conducted on patients with chronical ear infections: 50% of the patients are treated with drug A, the others are treated with drug B. If the drug has been efficient for a certain patient, what is the probability that this patient was treated with drug A?

(a) 0.5769 (b) 0.5111 (c) 0.4231

(d) 0.3333 (e) none of the preceding

Q4. In a box of 50 fuses there are 8 defective ones. We choose 5 fuses randomly (without replacement). What is the probability that all 5 fuses are not defective?

(a) 0.4015 (b) 0.84 (c) 0.3725

(d) 0.4275 (e) none of the preceding

Q5. Find the value of $P(X \leq 0.5)$ if the following probability density function is given:

$$f(x) = \begin{cases} 0 & \text{if } x \leq -1 \\ \frac{3}{4}(1 - x^2) & \text{if } -1 < x < 1 \\ 0 & \text{if } x \geq 1 \end{cases}$$

(a) 11/32 (b) 27/32 (c) 16/32

(d) 1 (e) none of the preceding

Q6. A receptionist receives on average 2 phone calls per minute. If the number of calls follows a Poisson process, what is the probability that the waiting time for call will be greater than 4 minutes?

(a) $e^{-1/15}$ (b) $e^{-1/30}$ (c) e^{-8} (d) e^{-1} (e) none of the preceding

Q7. A study on the quality of medical services in Canada indicates that the average waiting time for a surgery is 17.3 weeks. Assume that the waiting time for a surgery is normally distributed with a standard deviation of 1.9 weeks. What is the probability that a randomly chosen patient who needs surgery has to wait more than 22 weeks?

(a) 0.9932 (b) 0.9545 (c) 0.0068 (d) 0.9772 (e) none of the preceding

Q8. If $X \sim N(10, 1)$, the value of k such that $P(X \leq k) = 0.701944$ is closest to

(a) 10.53 (b) 0.30 (c) 0.53

(d) 0.53 (e) none of the preceding

Q9. Consider the following R output:

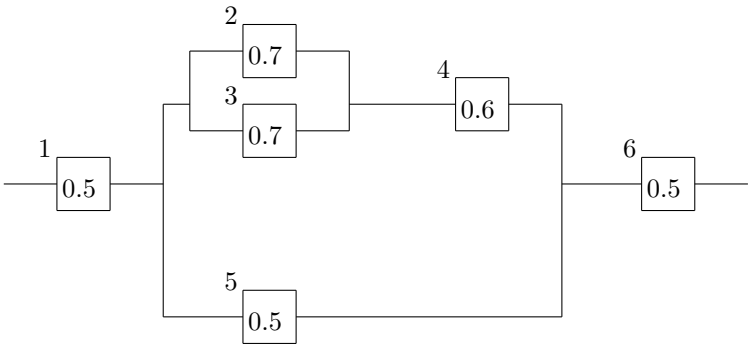
```
> pbinom(15,100,0.25)
[1] 0.01108327
> pbinom(16,100,0.25)
[1] 0.02111062
> pbinom(17,100,0.25)
[1] 0.03762626
> pbinom(30,100,0.25)
[1] 0.8962128
> pbinom(31,100,0.25)
[1] 0.9306511
> pbinom(32,100,0.25)
[1] 0.9554037
```

Let X be a binomial random variable with $n = 100$ and $p = 0.25$. Using the R output above, calculate $P(16 \leq X \leq 31)$.

(a) 0.9196 (b) 0.9095 (c) 0.9348

(d) 0.9443 (e) none of the preceding

Q10. Consider the following system with six components. We say that it is functional if there exists a path of functional components from left to right. The probability of each component functions is shown. Assume that the components function or fail independently. What is the probability that the system operates ?



(a) 0.1215 (b) 0.1932 (c) 0.7370 (d) 0.2046 (e) none of the preceding

This is the last question

Solutions to multiple choice questions:

Q1 $\longrightarrow$ d

Q2 $\longrightarrow$ a

Q3 $\longrightarrow$ a

Q4 $\longrightarrow$ a

Q5 $\longrightarrow$ b

Q6 $\longrightarrow$ c

Q7 $\longrightarrow$ c

Q8 $\longrightarrow$ a

Q9 $\longrightarrow$ a

Q10 $\longrightarrow$ b