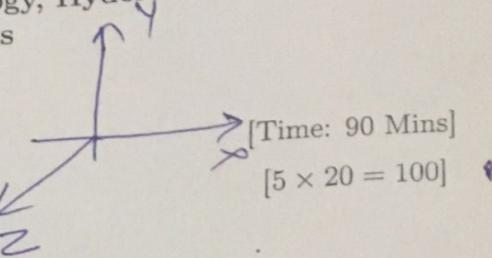


Max. Points: 100

Answer the following questions briefly and precisely. Avoid verbosity.

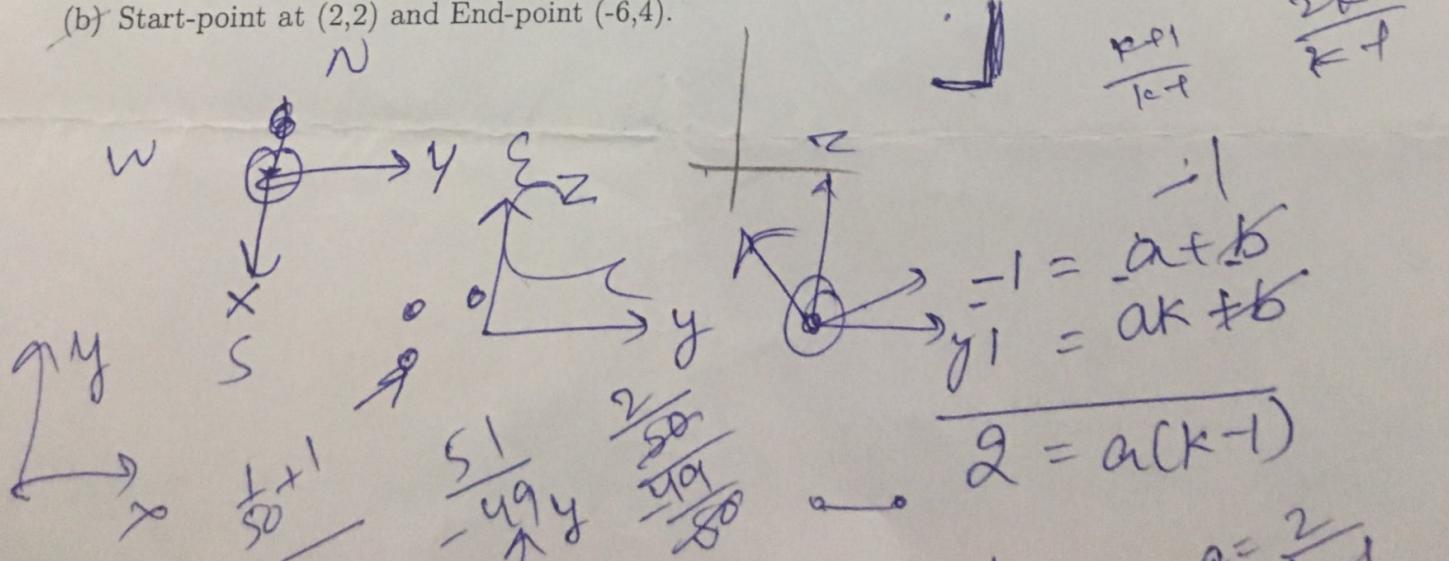


- Compute a single transformation matrix for the following composite transformation:  $T.R.S$ , where the translation is by the vector  $(30, 25, 10)$ , Scale is by a factor of 0.5 in both  $x$  and  $y$  axes, and 2.0 in the  $z$  axis, and the rotation is by 45 degrees about the vector  $(1, 1, \sqrt{2})$ . The above quantities are mentioned in cartesian co-ordinates, and you should work with homogeneous co-ordinates.
- Derive the composite transformation matrix for the above transformation.
  - Derive the composite transformation matrix for the above transformation.
  - If the order of rotation and translation are interchanged, will the resultant transformation be different? Why or why not?
- Derive the perspective projection matrix for the special case where the view frustum is symmetric with angles 90 degrees ( $\theta/2 = 45$ ) in both  $u$  and  $v$  directions. Assume the near plane to be at unit distance from the camera center and far plane at a distance of 50 units.
- Derive the transformation matrix required for moving from world coordinates (with axes  $X, Y, Z$ ) to view reference coordinates (with axes  $u, v, n$ ) ?
- Give the transformation matrix for pitch, yaw and roll in non-homogeneous coordinate system. Let  $Y$  be East,  $X$  be South, and  $Z$  be Up, provide the sequence of pitch, yaw and roll transformation for simulating following tasks.
  - An airplane parked facing East in Bhopal needs to fly to Delhi with take-off angle of  $\pi/6$ .
  - An airplane parked facing West in Bengaluru needs to fly to Kolkata with take-off angle of  $\pi/9$ .
  - An airplane parked facing South in Bengaluru needs to fly to Delhi with take-off angle of  $\pi/9$ .
- Provide dry run execution of integer DDA and Mid-point algorithms for rasterization of following line segments.

### direct differential analysis

(a) Start-point at  $(3,2)$  and End-point  $(6,8)$ .

(b) Start-point at  $(2,2)$  and End-point  $(-6,4)$ .



International Institute of Information Technology, Hyderabad  
CSE 251 : Spring 2017 : Computer Graphics  
*Final Exam*

Please answer concisely and precisely. Use illustrative diagrams instead of words wherever appropriate.

Max. Points: 100 marks

[Time: 120 Mins]



T R T

1. (a) Give the sequence of transformation needed to compute the location of a bead tied to a spoke of the wheel moving forward (clockwise) on a flat surface. Assume the parameters of motion and wheel structure as variables. [10]  
(b) What are the conditions when Perspective and Orthographic projection matrices converge (do write matrix form). [5]  
(c) Briefly describe various modules of a 3D Graphics pipeline. [5]
2. (a) Differentiate between object and image precision algorithm for visible surface determination. Derive formulation for depth computation used in the z-buffering algorithm. [10]  
(b) Construct BSP tree for following scene (show intermediate steps). [12]

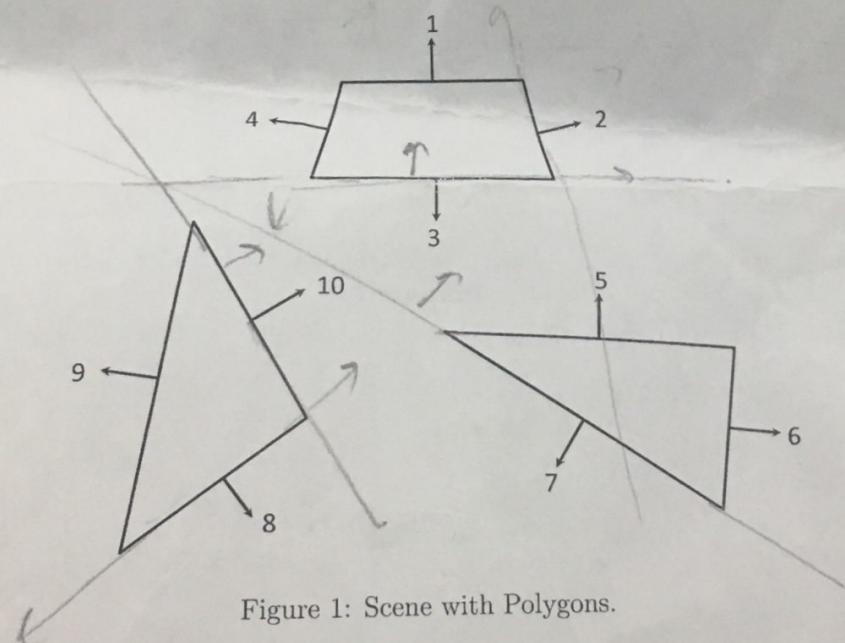


Figure 1: Scene with Polygons.

3. (a) Explain Phong's model of specular reflection. Give the construction of halfway vector based specular reflection model and when it is more suitable to use this model. [8]  
(b) Briefly explain Gouraud and Phong shading methods. Provide key limitation of former method addressed by the latter one. [8]

4. (a) Using examples, explain the concept of *parity checking*, *edge coherence* and *active edge table* in the context of scan converting a filled polygon. Explicitly list the special concerns/cases related to such scan conversion. [10]
- (b) Outline the Sutherland-Hodgman algorithm for polygon clipping. Provide intermediate steps for employing this algorithm for clipping the polygon given below. [12]

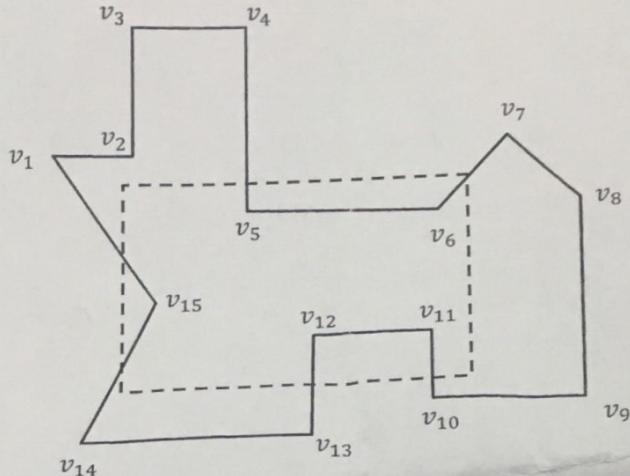
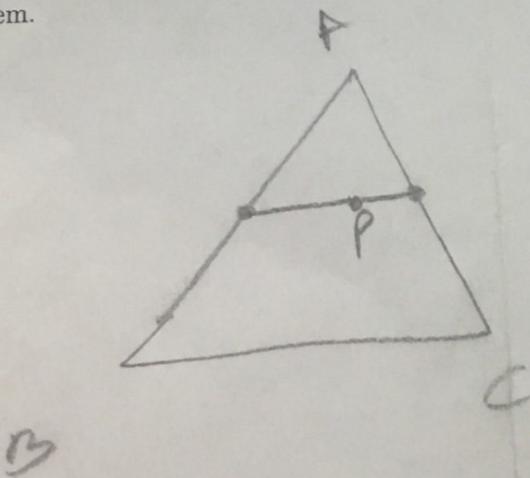


Figure 2: Polygon Clipping: Rectangle with dotted line as the clipping window

5. (a) Explain the concept of Ray Tracing. Show by example, how transparent and mirror-like objects can be handled in Ray Tracing using tree structures ? [10]
- (b) Derive the formulation for representing a point inside triangle using the Barycentric coordinate system. [10]

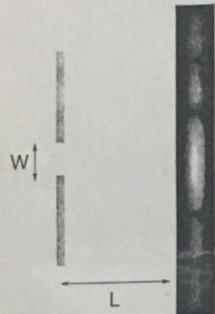


## Mid1 Examination

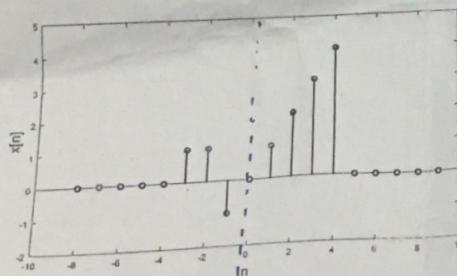
Digital Signal Analysis and Applications (DSAA) - IEC 239

Total : 15 marks

1. (1 mark) An image of Fraunhofer's single slit experiment is shown below (the diffraction pattern for a slit of width  $W$  is shown on the right). Do you think there is a mathematical relation between the shape of the slit and the observed diffraction pattern? If yes, explain how the diffraction pattern will change as the function of width ( $W$ ) of the slit in the case below.



2. (1.5 marks) Given  $x[n]$  below, plot  $x[-2n + 2]$ . Describe the procedure with the help of intermediate graphs.



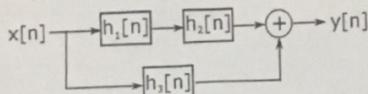
3. (2 marks) The median filter is often used for the smoothing of signals corrupted by impulse noise. It is implemented by sliding a window of odd length over the input sequence  $x[n]$  one sample at a time. At the  $n$ th instant, the input samples inside the window are rank ordered from the largest to the smallest in values, and the sample at the middle is the median value. The output  $y[n]$  of the median filter is then given

$y[n] = \text{med}\{x[n-k], \dots, x[n-1], x[n], x[n+1], \dots, x[n+k]\}$  where  $k$  is the window size. For example,  $\text{med}\{2, -3, 10, 5, -1\} = 2$ . Is the median filter a linear or non linear discrete time system? Is it time invariant? Justify your answer.

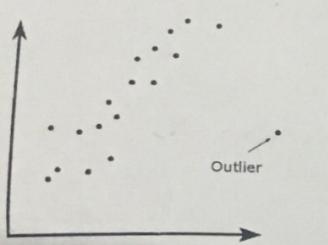
4. (2.5 marks) Determine the overall impulse response of the system (given in the figure below), where

$$h_1[n] = 2\delta[n-2] - 3\delta[n+1], h_2[n] = \delta[n-1] + 2\delta[n+2],$$

$$h_3[n] = 5\delta[n-5] + 7\delta[n-3] + 2\delta[n-1] - \delta[n] + 3\delta[n+1].$$



5. (2 marks) The observed values of input  $x$  (horizontal axis) and output  $y$  (vertical axis) are given below. We want to learn a straight line relation between them using ordinary least squares estimation. But it seems like one (or few) of our observations are extremely noisy (highly likely due to some error during measurement) and that may adversely affect the computed slope and intercept values. Suggest, how can we adjust the algorithm to handle such outliers.



$$\frac{2\pi}{8}$$

6. (2 marks) The first five points of the eight point DFT ( $N = 8$ ) of a real valued sequence are  $[0.25, 0.125 - j0.3018, 0, 0.125 - j0.0518, 0]$ . Determine the remaining three points. Prove the property of the DFT which will be used to get the values (using the DFT formula).

7. (4 marks) Consider the following function:  $v_k[n] = \cos\left(\frac{2\pi(2n+1)k}{4N}\right)$  for  $k = 0 : N-1$  and  $n = 0 : N-1$ . Keeping  $N = 4$ , compute the four vectors  $(v_0, v_1, v_2, v_3)$ . Prove that this set forms a basis in  $\mathbb{R}^4$ . Assuming that the above function forms a basis for any general  $N$ , give the equations to represent a vector  $x[n]$  (length  $N$ ) as the linear combination of the corresponding basis vectors.

{ These formulas might be helpful:  $\cos A \cos B = 1/2[\cos(A+B) + \cos(A-B)]$  and  $\cos A + \cos B = \frac{1}{2}\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$  }

$$x[n] = 0, 1, -1, 1, 2, -3, 10, 5, -1, 2, 1, -3, 1, 10, 5, 1, -1, 2, -3, 1, 5, -1, 2, -3, 1, 10, 5, 1, -1, \cos\left(\frac{\pi}{4}\right)$$

## Introduction to the Human Sciences (IHS201)

### First Mid-semester Exam

8<sup>th</sup> February 2017

Time: 90 minutes

Total Marks: 50

Question No 1 is compulsory.

You have to answer two questions each from sections A and B.

A total of five questions have to be answered, each has 10 marks.

#### Question 1:

Read the following text and answer the questions at the end of it.

As our perceptions of the great agitations launched by Mahatma Gandhi against the British Raj grows in subtlety and in detail, we are obliged to discard many dearly held views about the quality of nationalist politics in the subcontinent. It is clear, for instance, that hagiographical accounts portraying the political campaigns conducted by the Mahatma as monolithic struggles, which drew together all the peoples of the country in bonds of solidarity against the British Raj, are divorced from historical reality. It is also obvious that sectional interest and sectional conflict played an important part in nationalist politics; and it has to be conceded that important classes and communities often denied support to the Mahatma in his confrontations with the Raj. The myth of an all embracing nationalist movement, which united Hindu and Muslim, rich and poor, Gujarati and Bengali, or Punjabi and Behari, is all too easy to bury.

Yet what may prove equally misleading, in the long run, is the view advanced in a number of scholarly studies about the elitist quality of nationalist politics, and the extent to which nationalism was divorced from popular aspirations, no less than popular grievances, in the country. It is, therefore, fitting to emphasise, in the cities of the subcontinent, if not in its villages, the importance of popular participation in nationalist politics, particularly after the entry of Gandhi on the stage; to emphasise also the fact that the agitations led by the Mahatma rested upon loose alliances reflecting the interests and aspirations of a large number of classes and communities. Indeed, the most striking feature of the political campaigns conducted by Gandhi was the changing profile of the social groups which supported him at different stages of this struggle with the British Raj.

This changing quality of the Mahatma's support was related just as much to the politicisation of the new social groups in the country, as it was related to the emergence of a new, or the disappearance of old, issues in nationalist politics. Such, at any rate, is the picture which emerges from an examination of nationalist politics in the city of Bombay, the great metropolis of western India, in the crucial

at

years between the initiation of non-cooperation in 1920 and the conduct of civil disobedience during 1930-32.

The quality of politics in Bombay prior to 1920, and the role which the local leaders played in nationalist politics, has already been described in a number of excellent studies. These studies focus in the first instance, on the activities of the Bombay Presidency Association, a body representing the interests of the leading industrialists, merchants and professional men in the city. During the years of the First World War, however, the leaders of the Presidency Association were eclipsed by a new class of political activists who commenced an agitation for Home Rule, and who were successful in reaching out to the middle and lower middle classes of Bombay. The agitation for Home Rule, in turn, prepared the ground for the Rowlatt Satyagraha which Gandhi conducted in April 1919, in the city of Bombay and the rest of the country.

Although the Rowlatt Satyagraha was a remarkably successful agitation in the subcontinent as a whole, there is little reason to believe that it marked political breakthrough in Bombay. The leading men of the city, who were attracted to the Satyagraha, were men already active in the affairs of the Home Rule Leagues. Not all who were prominent in the affairs of the Home Rule Leagues, however, associated themselves with the Satyagraha, largely because of reservations about the style of Gandhi's politics. Popular participation in the Rowlatt Satyagraha, too, was in the main confined to the idle and lower middle classes, Gujarati or Maharashtrian, that had already been politicised by the agitators of the Home Rule movement. It would, therefore, be true to say that if the demonstrations of April 1919 in Bombay against the Rowlatt Act reflected any progress for the cause of nationalism, in addition to what the Home Rule leagues had already achieved, then this progress rested upon the subcontinental character of the Rowlatt Satyagraha, rather than upon the recruitment of new social groups in the city to the ranks of those who rejected the British Raj.

Indeed, the striking feature of the Rowlatt Satyagraha in Bombay was the extent to which it did not attract the working classes and, by and large, the Muslim community in the city. Bombay, it is important to remember, possessed a substantial population of Muslims. The city was also a great industrial metropolis, with a thriving textile and transport industry, a busy harbour and a flourishing commercial life. More than half the citizens of Bombay, in 1920, sustained themselves through work in industry, on the docks, or in the transport system. The working classes of Bombay, men drawn from the cultivating or untouchable castes of the surrounding rural districts, with a strong leavening of local Muslims, were unaffected by Gandhi's agitation against the Rowlatt Act, just as they were also unaffected by the activities of the Home Rule Leagues. Yet it would be a fallacy to assume that the working classes of Bombay were innocent of political consciousness. In particular, the textile workers of the city, despite the absence of trade unions among them, had struck repeatedly in the preceding decades to improve their conditions of livelihood. Again, in 1908, these impoverished citizens

of Bombay had staged a massive strike in protest against the conviction of Lokamanya Balgangadhar Tilak on charges of sedition by the Government of Bombay.

Why the workers of Bombay, particularly the 140,000 men employed in the textile industry, did not participate in the Rowlatt Satyagraha was as much a result of concurrent developments in industrial politics in the city as it was a consequence of Gandhi's attitude towards the working classes. The years of war, which were characterised by rising prices and by phenomenally high profits in industry (profits which the owners appropriated wholly to themselves), had generated acute disaffection among the workers by the time hostilities came to an end. In the first week of 1919, therefore, the textile workers of Bombay staged a strike to secure higher wages for themselves, and their example communicated itself to workers on the docks, in the transport and engineering industries and in various municipal organisations. Since the strike of January 1919 secured for the workers a substantial rise in wages, they could have been indifferent to the agitation against the Rowlatt Act. However, there is little reason to believe that Gandhi even attempted to reach out to the working classes, just as there is little reason to believe that the Home Rule Leagues had anything to do with the strike of January 1919, despite official suspicions to the contrary. The fact of the matter was that working class politics in Bombay, in 1919, were completely divorced from the politics of the middle and lower middle classes of the city. The gulf between these classes was to be bridged, with momentous consequences, during the campaign for non-cooperation that Gandhi launched in Bombay in 1920.

- a) What are the two errors of historical interpretation that the author seeks to redress in the beginning of the passage? (2 marks)
- b) Why did the working classes of Bombay remain aloof from the Home Rule movement and the Rowlatt Satyagraha? (3 marks)
- c) The author often uses "Mahatma" to refer to M K Gandhi. How would this, if at all, have any impact on the way this historian interprets evidence? (2 marks)
- d) When do you think this passage was written; after which year and before which year? (1 mark)
- e) Is any particular reason why the author uses the term subcontinent and not India? (1 mark)
- f) What school(s) of Indian historiography does the author subscribe to? (1 mark)

*Rev  
Ratier  
JR*

*Colonial Revolts*

**Section A**

(Answer any two of the following questions)

- 2) Describe how the modern discipline of history developed.
- 3)* How do Marxist historians analyse past societies?
- 4) What is the post-modernist critique of modernity? How does it impact the study of history?
- 5) Name the four schools of Indian history writing. Describe their main features.
- 6) What is the Annales method of studying history?

**Section B**

(Answer any two of the following questions)

- 7) How did sociology as a modern academic discipline develop?
- 8) What role did the idea of rationality play in the work of Weber?
- 9)* Who conceived the idea of social fact? What do you mean by social fact? Explain using examples.
- 10) How do you understand base and superstructure in a social formation? Do these Marxist categories help us understand society today?
- 11) Can there be a sociology of public transport? If so, how can you apply the idea of social imagination to understand the sociology of public transport?

End Semester Examination  
Introduction to the Human Sciences (IHS201)

Max Marks: 80

Date: 22 April 2017

- \* All questions in section A are compulsory.
- \* Answer one question each in sections B and C.
- \* Answer any two questions in section D.

### SECTION A

**Question 1.** Please read the passage given below and answer the questions which follow. All questions are compulsory.

What exactly is democracy? There is an old – and narrowly institutional – view of democracy that characterises it mainly in terms of elections and ballots. That view has been championed by many authors, including Samuel Huntington: 'Elections, open, free and fair, are the essence of democracy, the inescapable sine qua non.' However, in contemporary political philosophy the understanding of democracy has vastly broadened, so that democracy is no longer seen just in terms of the demands for public balloting (important as it may be in its limited context), but much more capacious, in terms of what John Rawls calls 'the exercise of public reason'. In his *Theory of Justice*, Rawls makes this his focus, and argues for seeing democracy as being centrally linked to public deliberation:

The definitive idea for deliberative democracy is the idea of deliberation itself. When citizens deliberate, they exchange views and debate their supporting reasons concerning public political questions.

(3) Jurgen Habermas, who has significantly enriched this way of looking at democracy, has drawn attention to the important fact that the reach of public reasoning has to include both 'moral questions of justice' and 'instrumental questions of power and coercion'.

Interestingly enough, the importance of public discussion received early historical recognition in India in quite a prominent way, which remains relevant to thinking about democracy and justice in India today. The so-called Buddhist Councils that took the form of organised discussion of different points of view, represented by participants drawn from different parts of India (and even outside it), were among the earliest social attempts at public reasoning – beginning in the sixth century BC. The championing of public discussion in India in the third century BC by Emperor Ashoka – who also hosted the largest Buddhist Council ever – is a good example.

Ashoka tried even to codify good rules of public discussion in one of his stone edicts that dealt both with individual conduct and public governance. Emperor Akbar's initiative in the sixteenth century in arranging public discussion on religious differences in the multicultural country over which he ruled can also be counted as part of the rich history of organised public discussion in India. However, neither Ashoka nor Akbar proposed democratic governance as far as state institutions are concerned. And even

though India has reason to remember with some pride the long tradition of public arguments, a modern democracy has to demand vastly more from public reasoning as a part of democratic practice than was championed either by Ashoka or by Akbar.

A closer entry into our questions comes from the approach of seeing democracy as 'government by discussion', a perspective that John Stuart Mill explored with great care and much insight (though the phrase – 'government by discussion' – was formulated later by Walter Bagehot). One limitation of seeing democracy exclusively – or even mainly – as a system of free elections and voting relates to the obvious fact that how people vote depends on their understanding of the problems to be addressed and also their perception of what others – as well as they themselves – have reason to seek. Social and economic problems are not always easy to see and understand, and a vigorous exercise of public reasoning can play a major role both in expanding public understanding and in broadening enlightened politics.

This is not to say that 'government by discussion' (even broadly interpreted) is the beginning and the end of democracy. The demands of democracy can be further extended, for instance to include – at least as an ideal – the requirement of equal participation. This was, for instance, a central concern of Dr.

(5) Ambedkar who argued for a far-reaching view of democracy, ultimately seen not just as a method of government, but as a 'mode of associated living'. But even Dr. Ambedkar took positive note of the idea of democracy as government by discussion, and public reasoning was certainly central to his understanding of it. Most of his public life, indeed, was devoted to public reasoning in one way or another.

....

Among other serious consequences of this asymmetry of voice and influence of different groups are corresponding biases in the allocation of public revenue, which are, of course, influenced by group interests. One of the benefits of rapid economic growth is that it ends to generate larger public revenue which can be used for different purposes – varying from reducing the deprivations of the underdogs to serving the interests of the relatively privileged. Indeed, public revenue in India has tended to grow as fast as – sometimes more so than – the growth of GDP in the recent past. This has had the result that the gross tax revenue of the central government is about four times as large today, at constant prices, as it was just twenty years ago.

In addition to drawing on the resources generated by the fast expansion of the GDP, it is possible to further expand the contribution of GDP growth to public revenue in many different ways, varying from preventing tax evasion, which is very large in India, to removing arbitrary exemptions and widening the tax base. Indeed, many constructive recommendations to raise India's tax-GDP ratio (which is quite low by international comparison), without choking off economic efficiency, have been made by successive expert committees. But even as things stand today, with public revenue growing more or less at par with GDP, the resources available for public spending are expanding fast in India. This is a valuable opportunity to make good use of public revenue for enhancing living conditions, through public services and support. But it has also allowed for the continuations – and sometimes expansion – of spending patterns that are not particularly easy to justify.

(2)

To illustrate, central government subsidies on petroleum and fertilizer alone are expected to cost more than 165,000 crores in 2012-13 (nearly 1.7 per cent of India's GDP) at the time of writing. This is about four times what the central government spends on health care. There is a mind-boggling imbalance here, but it somehow goes virtually unchallenged and even unnoticed. There are similar imbalances at the state level. In many states, for instances, public expenditures on health and education consists overwhelmingly of salary payments (often based on fairly generous pay scales), with very little left for other essential items such as textbooks or medicines. In some states, the payment of public-sector salaries and pensions now absorbs the bulk of state government revenue, crowding out other uses of public revenue and causing a serious threat of financial bankruptcy.

- Q 1 a)** Name the five modern thinkers whose ideas of democracy have been discussed? (1 mark)
- Q 1 b)** How much has gross tax revenues of the central government grown in the last twenty years? What is this a result of? (1 mark)
- Q 1 c)** How much is the central government spending on health care? (1 mark)
- Q 1 d)** What example of bias in allocation of public revenue has been given? (1 mark)
- Q 1 e)** What is the difference between the definition of democracy given by Samuel Huntington and that given by John Rawls? (1 mark)
- Q 1 f)** How did Ambedkar define democracy? (1 mark)
- Q 1 g)** What are the social factors which determine general patterns in public spending? And depending on these factors, what are the general policy trends in spending? (2 marks)
- Q 1 h)** Which modern structures of democracy have their roots in India's history? What are their limitations with respect to modern ideals and principles? (2 marks)
- Q 1 i)** Identify one state-level skew in public spending. What problems can it lead to? (2 marks)
- Q 1 j)** Explain how "democracy as public reasoning" as described by Rawls, Habermas and Ambedkar can help better allocation of public revenue? (4 marks)
- Q 1 k)** How does the passage suggest that the rise in GDP be used to improve India's Human Development Index? Will only increasing financial allocations help? (4 marks)

#### **SECTION B** (answer any one of the two questions)

**Question 2:** Explain the traditional analysis of knowledge (5 marks). Explain Edmund Gettier's counter examples (5 marks). How do Gettier cases work as counter examples to the traditional analysis of knowledge (5 marks)?

**Question 3:** Explain Act utilitarianism and Rule utilitarianism (5 marks). Explain the notions of Logical Consistency, Logical Truth, Logical Falsity and Logical Equivalence with one example for each (10 marks).

(3)

Concise

Planning

51 - Tenancy

56 - Industry

80 " Green revolution

### **SECTION C (answer any one of the two questions)**

**Question 4:** What were the factors that controlled the growth of banks and investment/merchant banks in the US after the 1930s? (5 marks), What were the changes in rules and practices from 1970s onwards that led to a rapid growth of the financial sector in the US (5 marks). If you had to identify one single immediate factor for the financial crisis of 2007-08, what would it be? And why? (5 marks)

**Question 5:** What were the main ways in which the Indian economy changed between 1947 and 1991? (8 marks) What were the broad achievements and failures (7 marks)?

51, 56, 61

### **SECTION D (answer any two of the six questions)**

**Question 6:** Describe the main features of Indian history till the end of the first millennium AD. (15 Marks)

**Question 7:** Trace out the development of the discipline of history in India from the times of the British Orientalists till the establishment of the National Archives of India. (15 marks)

**Question 8:** What are the three phases of the development of sociology as a discipline in India (5 marks)? Describe any one of the phases in detail (10 marks). In describing the phase you choose, include the central ideas developed, important thinkers and their contribution.

**Question 9:** Differentiate between natural inequality and constructed inequality (8 marks). Describe one of the theories to understand social stratification (7 marks).

**Question 10:** How does Ashutosh Varshney select cities in his study of ethnic conflict and civic life in India (5 marks)? What is the main variable that distinguishes peaceful cities from those with endemic violence (5 marks)? Illustrate your answer with examples from his study (5 marks).

**Question 11:** Why is India called a parliamentary federal system (7 marks)? Distinguish between presidential and parliamentary forms of government (8 marks).



Surat

Mumbai

Ahmedabad

Calcutta

Hyderabad

Lucknow

(4)

~~Jaipur~~  
~~Delhi~~  
~~Vadodara~~  
~~Gandhinagar~~  
~~Nagpur~~  
~~Jabalpur~~  
~~Jaipur~~  
~~Chennai~~  
~~Kolkata~~  
~~Chennai~~

## Introduction to the Human Sciences (IHS201)

### 2<sup>nd</sup> Mid-Semester Exam

18<sup>th</sup> March 2017

Total Marks: 50

Time: 90 minutes

Question No 1 is compulsory.

You have to answer ONE question section A, and THREE questions from section B.

#### Question 1:

Read the following passage and answer the questions at the end of it:

Information technology professionals often talk about their new-found affluence, stories that usually begin with a statement such as, 'I come from an ordinary middle-class family'. Their identification of 'ordinary', and 'modest' with middle-classness refers to the Nehruvian middle class of their parents' generation, who (they believe) had stable but relatively low-paying government jobs, led simple but satisfying lives, and sustained themselves through hard work and adherence to right values. Their 'middle-class' parents were of course wealthier than the majority of Indians, but their life stories nonetheless highlight a dramatic shift in their material circumstances and consumption practices...

Many software engineers said that they think nothing of eating in five-star hotels or purchasing expensive clothing, unlike their parents who would rarely visit restaurants or buy branded goods. In many cases, they have already secured an economic status that it took their parents a whole lifetime to achieve...

The fashioning of distinctive consumption patterns and life-styles has become a central element of middle-classness after liberalisation. The enhanced earning power of IT workers and other upwardly mobile professionals is at least partly responsible for the striking cultural and spatial shifts that have taken place in Bangalore since the 1990s. These changes are seen most clearly in the proliferation of upscale apartment buildings and 'gated communities', which have altered Bangalore's cityscape. Most software engineers and other young professionals live in large, self-contained apartment complexes, where services such as security, maintenance, and recreation are provided. Within these exclusive enclaves, an army of maids, cooks, drivers, and nannies looks after family needs and household work, freeing professional couples from routine chores and childcare so that they can concentrate on their work. The availability of domestic help and care workers is particularly important in enabling women IT professionals to pursue their careers, given that most live in nuclear households and may not have parents, parents-in-law, or other family members nearby to help them with childcare.

These new residential patterns reflect the sense of social disembedding that was expressed by many IT professionals. The standard '2BHK' (two bedrooms, hall, kitchen) apartment is very different from the small, independent bungalows that were favoured by the older generation of the middle and

lower classes, usually housing extended families. Bangalore's modern apartment complexes produce and reflect a new model of middle-class living, feeding into the homogenised 'new middle-class' culture that has emerged in the city and the dissolution of older kinship- or caste-based neighbourhoods.

Although IT professionals appreciate the comfortable lifestyle that has been enabled by their jobs, their narratives also reveals nostalgia for what they believe were the more fulfilling lives of their parents. Many expressed a sense of loss: 'Now I have enough money but no time to enjoy it,' was a common remark...

These narratives contrast the materialism, fragmentation, and fast pace of contemporary life negatively with 'traditional values' of sociality and family. Many respondents said that they were frustrated because they could not fulfil important family obligations or pursue personal interests because of their hectic work schedules. Older informants and senior managers also decried the consumerist orientation of young professionals...

This discomfort with materialism is linked to a wider middle class self-narration through the trope of morality, as several scholars have pointed out, Van Wessel's middle-class informants in Baroda spoke about consumption in moral terms, as both inevitable and dangerous. Lower middle class people in Hyderabad studied by Saavalala similarly condemned consumerism as anti-social and destructive. Drawing on the hoary opposition between 'Western materialism' and 'Eastern spirituality', these narratives inform notions of middle-class respectability: If the middle classes seemed eager to adopt modern lifestyles through the acquisition of consumer goods, they also became the self-appointed protectors of tradition.

Similar processes have been noted for the emerging middle classes elsewhere – class identity often takes on the form of a 'moral community' that adheres to traditional values yet is modern. 'Morality tales', usually revolving around the themes of 'family values', materialism and corruption, are key narratives of middle classness.

The construction of middle-class identity on the plank of morality is a relational process in which the middle class distinguishes itself from the poor and the rich alike, both being marked as immoral in different ways. IT professionals in Bangalore not only contrast the 'simple living, high thinking' ethos of the 'old middle class' with the current fascination with consumption, they also frame social distinctions as moral distinctions. In this way, the themes of morality and materiality are set in creative tension, laying the groundwork for a cultural politics of class distinction.

One way this ambivalence about consumption is resolved is by creating a separation between outward changes in material lifestyle and an authentic inner self that draws on unchanging 'core values'...

Thus, a dichotomisation of materiality and cultural values is a key element in the self-narration of this group. 'Middle class' stands for a particular set of moral standards and norms of living, which in turn are projected as the core of 'Indian culture' that can be sustained even as lifestyles and material circumstances may change. In contrast to both lower and higher middle class fractions, most IT professionals project themselves as solid middle-class citizens – responsible consumers who

save and invest money wisely plan for the future, and take responsibility for their families. They embrace the consumer culture that symbolises their membership in the 'new middle class', yet claim to uphold a moral code that condemns excessive individualism and consumerism as detrimental to family values. IT professionals often contrast their more conservative and tasteful consumption practices with the allegedly frivolous and hedonistic lifestyles of call centre workers, as well as with the affluent, trendy, and Westernised 'yuppy' set of Bangalore. 'Middle class values' is also a form a symbolic capital that is deployed to differentiate themselves from groups that seek to enter the middle from below, in particular lower-level service sector workers.

- a) What does the author identity as the essential contradiction faced by IT professionals? (2 marks)
- b) Identity different social categories that have been named/analysed here. (2 marks)
- c) In this passage, how does the middle-class in the IT sector define itself? (2 marks)
- d) What tools of social stratification analysis have been employed in this passage? Identity, and elaborate. (3 marks)
- e) Under which field(s) of sociology can this study be classified? (1 marks)

Ethno )

#### Section A

(Answer any ONE of the following questions)

2) What in brief are the main differences between the Classical School of Economics and the Neoclassical School? (approximately 300 words, 10 marks)

3)

- (i) The advantage of GDP is its simplicity as a measure of economic well-being. Discuss one major limitation in how this measure of well-being is estimated. (100 words, 4 marks)
- (ii) How does one normally compare the GDP of two countries? What is the problem with the conventional form of comparison? Name and discuss the alternative form of comparison. (200 words, 6 marks)

4) life exp, mea

- (i) How does the 'Human Development Index' differ from GDP? What normally go into the measurement of the HDI? Why is it seen as superior to the GDP as a measure of well-being? (200 words, 6 marks)
- (ii) In a group of 188 countries, Cuba has a much higher rank of HDI than GDP. On the other hand Kuwait has a much lower HDI rank than in GDP. What does this mean and what does it say about each country's priorities? (100 words, 4 marks)

## Section B

(Answer any THREE of the following questions)

- 5. What is politics and why is it found in all groups? (10 marks)
- 6. What is balance of power? Distinguish between different mechanisms that are used for this purpose. (10 marks) *with eco, alliance.*
- 7. Critically examine the limitations of the liberalism-idealism paradigm to understand international relations. (10 marks) *No focus to military power, Ideal concepts*
- 8. What are the main elements of David Easton's systems theory? How does it advance the study of comparative politics? (10 marks)
- 9. What are the three foundational values/goals in the Indian Constitution? Why does Granville Austin call them the seamless web? (10 marks)
- 10. Spell out the reasons as to why India adopted a strong-centre model of federalism. (10 marks)

1 /  
2) *Cause*

International Institute of Information Technology, Hyderabad  
Formal Methods

■ Mid Semester Exam ■

16-March-2016

**Instructions:**

- The exam is for 90 minutes duration, and is for a maximum of 50 points.
- NO clarifications shall be given during the exam. If you need to make any assumptions in solving any question, state your assumptions clearly.
- Answer all parts of each question contiguously.

**Problem I.** Design a DFA for the following languages. You cannot draw an NFA and claim equivalence. You must draw a DFA.

1.  $\{w \mid w \in \{0, 1\}^* \text{ and } w \text{ has } 010 \text{ as a substring}\}$
2.  $\{w \mid \text{every third position in } w \text{ is a } 0\}$
3.  $\{w \mid \text{has an odd number of } 1\text{'s and an odd number of } 0\text{'s}\}$

( $3 \times 10/3 = 10$  Points)

**Problem II.** Justify whether the following are true or false. In all the questions,  $R_1$  and  $R_2$  are two regular expressions.

1. If  $R_2 = \{\epsilon\}$ , then  $R_1 \cup R_2 = R_1$ .
2. If  $R_2 = \{\}$ , then  $R_2^* = \{\epsilon\}$ .
3. If  $R_1 = \{\}$ , then  $R_1 \circ R_2 = R_2$ .

( $3 \times 2 = 6$  Points)

**Problem III.** Write appropriate regular expressions for the following languages. You can specify the alphabet if it is not implicitly clear.

1. a variable name in the C-language, and
2. An IPv4 address

( $2 \times 2 = 4$  Points)

E.I.T.R

**Problem IV.** Convert the NFA in Figure 1 to its equivalent DFA. If there are any redundant states in the resulting DFA, mention them along with a brief justification. Show all your work.

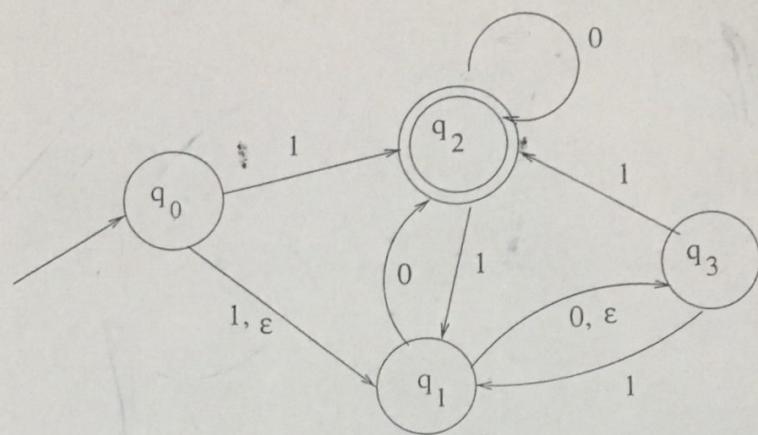


Figure 1: An NFA.

(6+4=10 Points)

**Problem V.** Find the regular expression that corresponds to the NFA in Figure 1. Use the procedure discussed in class. Show all your work.

(6+4=10 Points)

$a_1 \sim g_1 v^3$        $a_2 \sim g_2 v^2$   
 $a_3 \sim g_3 v^3$        $a_4 \sim g_4 v^2$

$$q_2 \uparrow, q_3$$

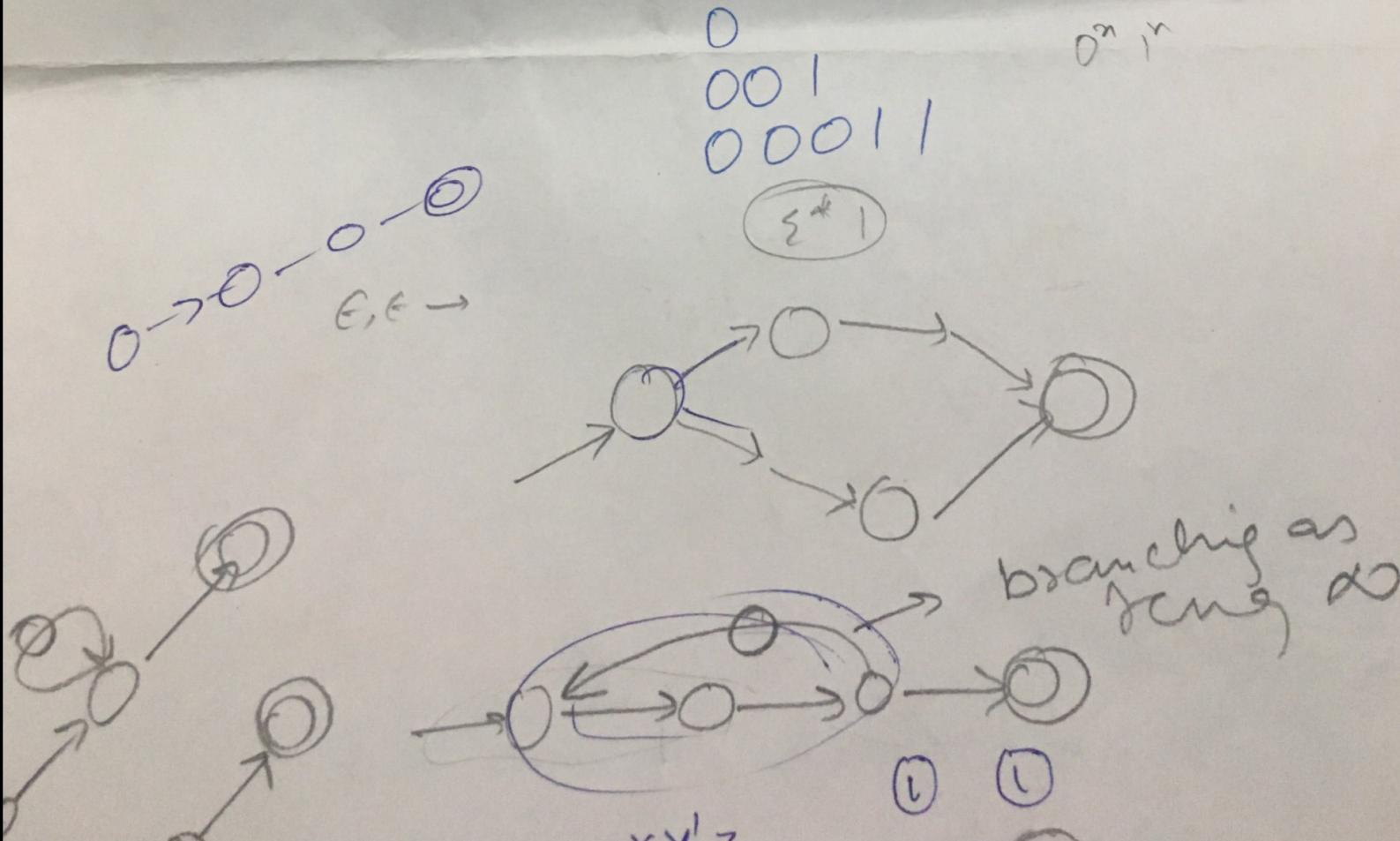
**Mid-Semester Examination**  
**Formal Methods**  
**05 Apr 2017**

Time: 1.5 Hours

Total Marks: 30

**Instruction:** Attempt all questions. Each answer should be brief and to the point. Doubts would not be clarified during the exam.

1. For languages  $A$  and  $B$  over an alphabet  $\Sigma$ , let the *almost perfect shuffle* of  $A$  and  $B$  be the language  $\{ w \mid w = a_1b_1a_2b_2 \dots a_{k-1}b_{k-1}a_k \text{ where } a_1a_2 \dots a_k \in A \text{ and } b_1b_2 \dots b_{k-1} \in B, \text{ each } a_i, b_i \in \Sigma \}$ . Show that the class of regular languages is closed under almost perfect shuffle. [5 marks]
2. Prove that the set of regular languages over a given alphabet is closed under intersection. Note that the intersection of two languages  $L_1$  and  $L_2$  over a given alphabet  $\Sigma$  is the set  $L_1 \cap L_2$ . [5 marks]
3. Prove that the language  $\{ w \mid w \in \{0, 1\}^* \text{ is a palindrome of even length} \}$  is not regular. Note that a palindrome is a string that reads the same forward and backward. [5 marks]
4. Prove that the language  $\{ w \mid w \text{ is a binary number that is a multiple of 7} \}$  is regular. [5 marks]
5. Let  $L$  be a regular language containing infinitely many strings over an alphabet  $\Sigma$ . Prove that  $L$  can be partitioned into two disjoint sets  $L_1$  and  $L_2$  such that both  $L_1$  and  $L_2$  are regular languages, each containing infinitely many strings. Note that  $L = L_1 \cup L_2$  and  $L_1 \cap L_2 = \emptyset$ . [5 marks]
6. Construct a push-down automata for the language  $\{ 0^n 1^{n-1} \mid n \geq 1 \}$ . Clearly mention the set of states, input alphabet, set of stack symbols, transition functions, the start state and the accept state(s) of the automata that you construct. [5 marks]



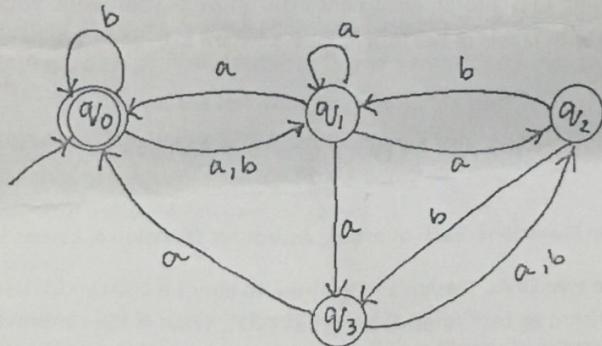
Formal Methods  
End Semester Examination  
IIIT Hyderabad

Instructions:

- The exam is for 70 points and for duration of 180 minutes.
- Questions use standard notation and acronyms as introduced in lectures.
- No clarifications shall be given during the exam.
- Questions are arranged across three sections with increasing difficulty across sections. Answer questions from each section contiguously. Further, answer all parts of a question together.

**Section I.** Questions on Basic Knowledge. Each question carries FOUR points.

1. Convert the following NFA into its equivalent DFA. Identify redundant states if any.



(3+1 = 4 points)

2. Define the Chomsky normal form of a CFG. Convert the following CFG into the Chomsky normal form. (1+3 = 4 points)

$S \rightarrow ABS \mid BAS \mid \epsilon, \quad A \rightarrow CaB \mid a \mid b \mid \epsilon, \quad B \rightarrow CbA \mid a \mid b \mid \epsilon$ , and  $C \rightarrow CABA \mid C \mid \epsilon$ .

3. In the normalized notation, floating point numbers are written as  $n.a_1a_2\dots \times 10^p$  where  $n$  is an integer with  $1 \leq |n| \leq 9$ ,  $p$  is an integer, and  $a_1, a_2, \dots$ , are from  $\{0, 1, \dots, 9\}$ . (For negative numbers,  $n$  is negative). Example numbers in the normalized notation are  $3.14 \times 10^5$ ,

-1.273x10^-5. Write a regular expression for the class of floating point numbers in the normalized notation. Convert your expression to an NFA. (Note: The carat symbol is included so as to be used as the exponentiation symbol. Your expression will also therefore contain this symbol.)

(2+2 = 4 points)

4. Fill in the following blanks with a short justification.

- A CFG is called ambiguous if \_\_\_\_\_.
- CSLs cannot contain the string  $\epsilon$  as a member because \_\_\_\_\_.
- If an NFA with  $n$  states out of which  $p$  states are accept states is converted to its equivalent DFA, then an upper bound on the number of accept states in the DFA is \_\_\_\_\_.
- The minimum number of states in a Turing machine is \_\_\_\_\_ as \_\_\_\_\_.

(1 x 4 = points)

5. Convert the following CFG into an equivalent PDA. Show all your work. Your PDA should be in the standard form with labels of the form  $a, b \rightarrow c$  where  $a, b$ , and  $c$  are symbols from the stack alphabet.

$$S \rightarrow SAS \mid SBS \mid \epsilon, \quad A \rightarrow AB \mid BA \mid a, \quad B \rightarrow BAA \mid SA \mid b$$

## Section II. Comprehension Questions. Each question, except for Question 4, carries SIX points.

1. Let  $M_1$  and  $M_2$  be two DFAs. Design an algorithm to check if  $L(M_1) = \emptyset$ . Use your answer above to design an algorithm to test whether  $L(M_1) = L(M_2)$ . What is the runtimes of your algorithms? (2 + 2 + 2 = 6 points).

2. Use the most suitable pumping lemma and determine which class of languages the following do NOT belong to:

- $L = \{ww^Rw \mid w \text{ in } \{0, 1\}^*\}$
- $L = \{a^ib^jc^k \mid i = j+k, i, j, k \geq 0\}$

(3+3 = 6 Points)

3. Let  $L$  be any language. Define  $L^c$  as the language  $L^c := \{w \mid w \text{ not in } L\}$ . Prove or disprove the following statements with proper justification.

- If  $L$  is a recursive language, then also  $L^c$  is recursive.
- If  $L$  and  $L^c$  are both recursively enumerable, then  $L$  and  $L^c$  are both recursive.

(3+3 = 6 Points)

4. This question is for 12 points. Design the most appropriate machine/automata to recognize the following languages. Points will depend on the appropriateness of the designed machine.

- a.  $L = \{a^i b^j c^k \mid i+j \text{ is even or } i+k \text{ is even, } i, j, k \geq 1\}$
  - b.  $L = \{ww^R w^R \mid w \text{ in } \{0, 1\}^*\}$
  - c.  $L = \{w \mid w \bmod 5 \geq 2, \text{ when } w \text{ is interpreted as a natural number written in the binary form}\}$
  - d.  $L = \{w \mid w \text{ in } \{0, 1\}^* \text{ and some two } 0's \text{ in } w \text{ are separated a number of symbols that is a multiple of } 3\}$ . For example, 001110 is a member of L as the second and the last 0 are separated by three 1's.

You should also provide a brief intuitive justification of the correctness of your machine. A mere state diagram or transition table will not suffice.

(3 x 4 = 12 points)

**Section III.** Analysis and Application Questions. These questions require you to carefully think and apply concepts learnt so far. Each question below carries 10 points.

1. Think of a 2-PDA as a PDA that now has two stacks instead of a single stack. A 2-PDA has a set of states  $Q$ , an input alphabet  $\Sigma$ , stack alphabets  $\Gamma_1$  and  $\Gamma_2$  both of which are proper supersets of  $\Sigma$ , a start state  $q_0$ , a set of final states  $F \subseteq Q$ , and a transition function  $\delta$  such that  $\delta : Q \times \Sigma \times \Gamma_1 \times \Gamma_2 \rightarrow 2^{Q \times \Gamma_1 \times \Gamma_2}$ . Answer the following questions.

  - Design or explain how a 2-PDA can accept the language  $L = \{ww^Rw \mid w \text{ in } \{0, 1\}^*\}$ .
  - What class of languages can a 2-PDA accept?
  - Justify your answer from part (b) above.

(2+2+6 = 10 points)

2. Let  $L$  be a CFL with a CFG  $G$ . Answer the following questions.

  - Suppose that we convert  $G$  into its equivalent Chomsky normal form grammar  $G'$ . Show and prove a strong upper bound on the number of productions in  $G'$  as a function of the number of productions in  $G$ . Under what conditions is the upper bound above reached?
  - Show and prove an upper bound on the number of steps in deriving a string of length  $n \geq 1$  from the grammar  $G'$ .

(5+5 = 10 points)